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ENVIRONMENTAL SCAN

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International
Environmental
Issues

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The Canadian Council of Ministers of the Environment (CCME) is the major intergovernmental forum in Canada for discussion and joint action on environmental issues of national, international and global concern. Environment ministers from each of the ten provinces, the federal government, and the two territories participate in council meetings at least twice a year. They discuss environmental issues, exchange information, make decisions and establish policy for work to be carried out under the auspices of CCME.

The presidency of CCME and other official posts are rotated annually among member governments.

Canadian Council of Ministers of the Environment
326 Broadway, Suite 400
Winnipeg, Manitoba R3C 0S5

Tel (204) 948-2090 Fax (204) 948-2125

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EXECUTIVE SUMMARY

FORCES DRIVING ENVIRONMENTAL POLICY

Canadian environmental policy at both the federal and the provincial/territorial levels is influenced by a number of factors, chief among which are:

- the continuing deterioration in environmental quality,
- sustained public concern,
- the influence of international issues,
- the costs of traditional approaches to environmental management.

CONTINUING DETERIORATION IN ENVIRONMENTAL QUALITY

Although there have been notable achievements in recent years in addressing the effects of environmental deterioration at the national and international levels, environmental quality as a whole continues to decline. At the global level, the trends signaled by the Brundtland Commission — the depletion of the ozone layer, the threat of climatic change, the loss of biodiversity, tropical deforestation and the spread of deserts — all continue largely unabated. At the national level, the major concerns relate both to the management of renewable resources and pollution. Some examples:

- in the last 15 years, the amount of wildlands in Canada has declined by four percent;
- the area logged exceeds the area successfully regenerated by approximately 250,000 hectares annually;
- all the Great Lakes are threatened by an accumulating load of toxic contaminants;
- proposed reductions in sulphur dioxide emissions will allow only about nine percent of lakes already acidified to recover.

SUSTAINED PUBLIC CONCERN

Public concern over the environment has increased markedly since the mid-80s, largely as a result of the fear of Canadians that pollution is starting to affect their health: nine out of ten Canadians believe that pollution will adversely affect public health and a slightly smaller number believe that the very survival of the human species is at stake. The link Canadians increasingly make between environmental quality and health implies that concern over the environment will remain high over time even if it temporarily subsides as a result of constitutional or economic factors.

As Canadians become more concerned about the possible health effects of environmental degradation, they become more critical of both government and industry: in the fall of 1989, over a third of Canadians believed that the federal and provincial governments were doing a poor job of protecting the environment, double the number who were sceptical two years earlier. The rising public concern over the deteriorating environment, coupled with the declining trust of Canadians in their governments, makes the context in which environmental policy is developed very volatile (see charts in main report).

INFLUENCE OF INTERNATIONAL ISSUES

The domestic environmental agenda will increasingly be influenced by international factors. As Canadians must learn to compete in a global economy, so must their environmental policies reflect international trends. The first two disputes under the Free Trade Agreement to reach the dispute-resolution mechanism dealt with resource management practices (salmon landings on the West Coast, the size of caught lobster off the East Coast). International protocols, such as the Montreal protocol, already guide domestic policy. A possible global climate convention, scheduled for UNCED '92, would have a major impact on Canadian energy policy.

COSTS OF TRADITIONAL APPROACHES

The last major factor driving Canadian environmental policies is that the traditional "react and cure" approaches are becoming prohibitively expensive. An Ottawa economic consulting firm has calculated that the incremental costs to the year 2000 of reducing water and air pollution, including the emission of greenhouse gases, could amount to $90-billion. At a time of continuing budget deficits and forecasts of sluggish economic growth, no country will be able to afford an environmental policy based exclusively on remedial action. The high cost of environmental protection and rehabilitation will require that greater attention be given to defining the costs and benefits of environmental objectives. It will also force a policy shift from remedial approaches to anticipatory and preventive strategies. The need to "anticipate and prevent" environmental damage will change profoundly the way in which policy is formulated and implemented in the future.

THE CHANGING POLICY ENVIRONMENT

The way in which the federal, provincial and territorial governments make environmental policy will be greatly influenced by the considerations outlined above. The report focuses on four factors in particular in analyzing this change: the demand for greater accountability, the need to integrate environmental considerations into economic decision-making, the greater use of economic instruments and environmental reporting (see the section on improved decision-making in Chapter 3).

ACCOUNTABILITY

Accountability is emerging as one of the key environmental issues of the 1990s. Many of the institutional reforms which are the subject of public debate have increased accountability as a common theme: this is true of environmental assessment, the creation of an environmental ombudsman or auditor, the enactment of environmental bills of rights (creating more opportunities for public input in decision-making) and the development of environmental indicators.

Low confidence in government and large corporations is at the root of the rising public concern over accountability. As the public becomes increasingly concerned about the economic and health costs of environmental degradation, it will demand a more thorough accounting by both government and the private sector of the actions they take to protect and restore environmental quality.

ENVIRONMENTAL ASSESSMENT

Environmental assessment has become a lightning rod for all stakeholders in environmental policy: environmental groups lobby for a rigorous application of the process; industry worries about uncertainty and the potential for costly delay; provincial governments try to protect their jurisdiction from perceived federal encroachment; the federal government is concerned about losing control over its process to the courts. It will continue to be a very high profile issue, in part because its application remains one of the most visible manifestations of the extent of governments' commitment to the environment. Furthermore, the application of the process provides an endless series of platforms for confrontation.

Although most political and media attention is likely to focus on seemingly isolated causes célèbres (such as Rafferty-Alameda, Oldman, James Bay II), these are in fact the outward manifestations of more fundamental cross-cutting issues. These issues include:

- the scope of the process, including its application to policies and programs as well as projects;
- auditing and monitoring process;
- public review; and
- interjurisdictional cooperation.

ENVIRONMENTAL AUDITOR

The idea that an independent environmental auditor should be established to oversee the implementation of the federal government's environmental decision-making process has gained considerable currency in the last two years. In his latest Annual Report, the Auditor General of Canada identifies the adequacy of environmental accountability as one of the issues that his Office will monitor in the future.

PUBLIC CONSULTATION

Fuelled by mistrust, public expectations about the appropriate forms of consultation are rising faster than governments' ability or willingness to deliver. This is true even though governments engage in more consultation than ever before. As a result of rising expectations, governments face a ratcheting effect: the previous "good" consultation process becomes the minimum standard for the next one.

The consultation load will increase rapidly in the next few years. The federal government is already committed to a series of consultations as a result of the Canadian Environmental Protection Act and the Green Plan. Provincial and territorial governments and the Round Tables will hold their own. This trend raises a series of questions: how will governments derive maximum value from these consultations? how can the public and stakeholders make the most effective contribution? how should consultation processes be "matched" to the kind of advice sought? how can overload, consultation "fatigue" and cynicism be prevented?

ENVIRONMENTAL BILLS OF RIGHTS

An alternative to direct government regulation of polluters is the "environmental bill of rights". These bills come in the form of legislation enabling the individual, rather than the state, to enforce environmental laws. Other important components of such legislation are the provision of compensatory damages for general harm to the environment; protection from discrimination for public servants who disclose environmental violations of their employers; public access to government information; and the office of an environmental auditor or ombudsman with a broad mandate to investigate and advise on the performance of agencies, management strategies and legislation and to provide access to information.

ENVIRONMENT/ECONOMY INTEGRATION

Changes in decision-making

The greater weight being placed on environmental factors is changing decision-making practices at all levels of government, in industry and in individual behaviour.

All levels of government have recently taken initiatives in the areas of internal organization, planning processes, public consultation and project assessment to integrate environmental considerations more effectively in their decision-making. Several other jurisdictions can also point to the establishment of Cabinet or senior-level committees to promote sustainable development. These structural and procedural reforms will continue. Comparable changes can be expected in the private sector, where codes of ethics, environmental audits, and making senior decision-makers accountable for environmental issues are becoming increasingly prevalent. Individuals, too, are beginning to change their behaviour as the success of the "blue box" recycling programs and the marketing of "green products" attest.

The goal of these changes is to ensure that the health of the ecosystem is maintained and, where necessary, restored, for the use of present and future generations. The essence of ecosystemic management — reconciling the fundamental incongruity between political and ecological boundaries and transcending the parochial tendencies of individual jurisdictions in favour of advancing the common good — represents a formidable institutional challenge.

Round Tables

The social experiment which the Round Tables represent is still inconclusive. None has yet gone through the hard choices necessary to integrate environment and economics in the form of a sustainable development strategy. None has yet presented a report to its government that requires immediate action. The value of this experiment, however, will become clear very soon. Over the next two years, most CCME governments will have to react to the conservation or sustainable development strategies which the Round Tables are preparing. The National Round Table will not produce a national conservation strategy although it will initiate a series of "dialogues" among stakeholders in various economic sectors.

ECONOMIC INSTRUMENTS

The market system is widely seen as the most efficient means of allocating resources. In a market-based economy such as Canada's the efficient allocation of resources will require the greater use of economic instruments to achieve the country's environmental objectives.

Environmental policy in North America has been dominated by the traditional "command and control" approach to regulation. This approach is characterized by phrases such as "best available technology" or "best practicable technology". The command and control approach has very real political advantages, especially in an age of public concern with the environment. It appears simple, it treats everyone the same way, and it is often combined with pledges to punish polluters severely. It may also be popular with some segments of industry who see it as predictable, creating a level playing field and being less technologically risky than other methods.

Critics, however, point out that it stifles the development of new technologies, especially in the form where the regulation can actually specify the technology. The Green Plan contains a provision for the release of a discussion paper in 1991 on the use of economic instruments in environmental protection.

Measuring Ecological Capital

The merging of environment and economics requires that we treat the world's renewable natural resources as capital and that we attempt to live off the interest of that capital, rather than constantly running down the principal as the statistics tell us we now do. This will require accounting for the ecological capital in a country's balance sheet, much as we now account for the manmade capital of housing, factories, roads, machinery and the like.

Market Based Incentives

Though command and control may continue as an approach to regulation, arguments have been advanced that a more efficient allocation of both government and social resources would result from a greater use of market based incentives. Various types of pollution would be treated as costs imposed on society in the form of depreciating natural capital, morbidity and mortality, aesthetic damage, and so on.

Because they employ market mechanisms, incentives should be superior to command and control in making product prices reflect true production costs. Market based incentives will not entirely eliminate reliance on command and control. Many environmental actions governments must take are of a non-market character — the development of parks or the protection of endangered species, for example. It must also be noted that an incentive based approach would not reduce governments' regulatory responsibility. As with "command and control", governments would continue to set regulatory agendas, establish standards, and ensure compliance. Nor would the use of market based incentives diminish the need for government support of research into pollution causes and effects.

Market-based incentives include pollution taxes and charges, emission permits, tax incentives and subsidies, and the privatization of some common property resources. These policy instruments are discussed in Chapter 3.

ENVIRONMENTAL REPORTING

As the link between human health and environmental quality becomes more firmly established, public demand for access to environmental information will increase. Today, such information often does not exist, is inconsistent or is inaccessible. The lack of reliable environmental information constitutes an obstacle to decision-making in several fields. The federal government's Green Plan makes a number of commitments to improve this situation, including natural resource accounting, a national environmental information network, a national state of the environment organization, and environmental indicators. Canada, Manitoba, Saskatchewan and British Columbia are all to release State of the Environment reports in 1991.

Indicators

The public judges a government's economic performance informally by referring to a wide array of economic indicators. These indicators play a powerful role in communicating to the electorate what is the state of the economy. They not only influence decisions taken by consumers and investors but also the government's political popularity. There is no parallel system of environmental indicators in Canada today which would allow the electorate to judge the government's environmental performance. The federal government published in early 1991 a preliminary set of environmental indicators for Canada.

INTERNATIONAL ISSUES

Ozone depletion

The Montreal Protocol, first negotiated in 1987 and strengthened in 1989, is one of the few successful attempts to remedy an international environmental issue. Mr. de Cotret recently announced that Canada is already ahead of schedule in eliminating CFC production.

Climate change

Global warming s the most important issue to emerge on the international scene. Since land masses at higher latitudes are expected to experience two to three times the level of warming, Canada could be affected to a far greater extent than many other nations.

Although the exact consequences of global climatic warming are unknown, it is expected that major shifts in rainfall patterns, massive flooding in low lying countries and unpredictable changes in agriculture, forestry and plant and animal habitat will result. The Second World Climate Conference held in 1990 agreed that negotiations for a binding international agreement on climate change should begin this year.

Controlling emissions of greenhouse gases has obvious ramifications for a major energy producer like Canada. Although we produce only two percent of the world's emissions of CO2, we are one of the largest per capita producers of greenhouse gases in the industrialized world. In the absence of concrete actions to curb emissions, the Green Plan predicts a 17 percent increase in Canadian CO2 emissions by the year 2000. The Green Plan proposes, therefore, the beginning of a national strategy for CO2 limitation.

Forestry

Another international issue is tropical deforestation. Forests perform a range of functions, including employment, a carbon sink, provision of the most diverse ecosystems known to mankind, climate moderation and soil and water management. The realization that the world's main repositories of genetic diversity are disappearing is a major cause of the public's concern over the environment. The Houston Economic Summit proposed a world agreement on forestry be prepared for the 1992 Conference in Brazil. Canada has been one of the most active proponents for such a convention.

Air toxics

Air toxics are a problem of international scope due to the long range transport of air borne pollutants. Concern for these air pollutants led to the 1979 ECE Convention on Long Range Transport of Air Pollution and a protocol for international monitoring and assessment. In 1985 the ECE created the Helsinki

Protocol which calls for a 30 percent reduction in sulphur dioxide emissions. In 1988, Canada, along with the U.S. and other nations, signed on to the Helsinki Protocol committing to an additional freeze of nitrous oxide emissions at 1987 levels. In Canada's Green Plan the government states its intention to press for renegotiation of the Helsinki Protocol to include volatile organic compound (VOCs) emissions.

On the Canada-U.S. agenda, acid rain is the best-known air toxic issue. In Canada, the effects of acid rain have damaged an estimated 150,000 lakes with 14,000 already considered "dead". An increase in human respiratory problems is also attributed to acid rain. Estimates place the annual cost of acid rain to the national economy at $1-billion. Bilateral cooperation has led to the 1979 Memorandum of Intent concerning Transboundary Air Pollution and the Great Lakes Water Quality Agreement, favouring joint research and negotiation. A Transboundary Air Quality Agreement, modeled after the Great Lakes agreement, is currently at the negotiating stage.

The Green Plan contains a commitment to implement a ten-year management plan, adopted by the CCME in 1988, to reduce NOx and VOCs emissions in problem areas by 40 percent by the year 2000; and to cap the nation's sulphur dioxide emissions for the year 2000.

The Great Lakes

In spite of all the attention, Great Lakes pollution problems persist. The problem is in three parts. First, historic deposition of persistent pollutants like PCBs and heavy metals like lead remain in many areas of the Great Lakes. Second, current discharges continue to threaten the lakes' water quality with both biological and toxic chemical pollutants. In addition to these point-source discharges, there are non point-source ones involving farmland run-off containing chemical fertilizers and pesticides, and chemical and biological leachate migrating from abandoned dumps. There have been some successes in cleaning up the discharges to the Great Lakes. Eutrophication caused by biological discharges has been reversed. Over $10-billion has been spent by the U.S. and Canada on building and improving municipal sewage treatment plants, but this has been insufficient to keep up with industrial growth in the region. The bilateral Great Lakes Water Quality Agreement of 1978 calls for "zero discharge" of these industrial pollutants.

NATIONAL ISSUES

Air Quality

Air quality in most Canadian cities with population in excess of 100,000 is monitored by the federal government through the National Air Pollution Surveillance. Ground level ozone is the most serious of the measured air pollutants and is being produced in greater concentrations each year. In 1987, 52 percent of the stations recorded ozone concentrations higher than the maximum acceptable level set by the National Ambient Air Quality Objectives. The major urban source of ozone is the exhaust from gasoline powered vehicles. The Green Plan has set a nationwide goal to reduce ground level ozone.

Water Quality

Water is Canada's most abundant natural resource. It is also the most abused and undervalued. Our aquatic ecosystem is under stress due to manmade inputs from both land and air. Some of the most pressing problems include: untreated sewage, industrial waste products, physical degradation such as wetland drainage and chemical loading from air borne transport of pollutants.

Urban wastewater, much of it found in the same watercourses that we depend upon for drinking water, has several sources. The most significant is sewage. Only half of the nation's urban population is served by secondary sewage treatment or better. Industrial wastes are either rich in organic matter which depletes oxygen levels in water thus killing aquatic organisms, or contain chemicals that are either lethal or accumulate in the food chain thereby making fish unfit for human consumption.

From 1971 to 1981, water withdrawals increased in Canada by over 50 percent, while the population increased only five percent. The "user-pay" or "full-cost pricing" approach is not applied systematically to water in any of its uses.

Solid and Hazardous Wastes

Waste disposal is rapidly becoming the most critical issue facing larger municipalities. The problem is exacerbated by rising disposal costs and increasing financial restraint. Waste disposal is a provincial, municipal and national problem. Planning and action is required across a broad front — reduction, re-use, recycling and recovery — using all the tools available to governments, such as education, regulation and research and development. Packaging is the single largest component of solid waste. The CCME has endorsed a 1990 National Packaging Protocol to reduce packaging by 50 percent by the year 2000.

Canadians produce eight million tonnes each year of hazardous waste of which only 40 percent is treated. Clearly, management must begin with a substantial reduction of the chemicals produced. The Green Plan proposes the reduction, safe transportation and disposal of hazardous wastes in Canada through: the destruction of all PCBs under federal jurisdiction by 1996; development of technology to recycle or destroy hazardous waste; and federal-provincial regulations for the safe management of waste transportation and disposal sites.

Forests

Canada has approximately 453 million acres of forest land and one of the world's largest forest industries. This country possesses 25 percent of the world forest market. During the 1980s, 650 million trees were harvested annually, resulting in direct forest industry employment of 270,000 and an export value of $23-billion. The economic importance of the forest industry has overshadowed the ecological importance of forest ecosystems.

Management of the industry is characterized by practices, such as clear-cutting, that maximize the value of lumber and ignore the value of the forest as habitat for wildlife, a purifier of air and water, a windbreak across flatlands and protection against erosion and flooding. There is serious concern that both the present level and method of harvesting cannot be sustained. Due to diminishing stocks, Canada's Annual Allowable Cut has dropped from 256 million cubic metres in 1970 to 204 million in 1986. The Canadian Council of Forest Ministers has recommended that forest management account for non-timber values such as wildlife, fisheries and recreation, and that resource allocation to exclusive uses, such as lumber, be subject to rigorous cost/benefit analysis.

Energy

The environmental consequences of energy use are pervasive, playing an important, if not dominant, role in many of the key environmental issues of the day. The most serious pollution problems globally — climate change, depletion of the ozone layer, acidification and urban air pollution — are all attributable to a large degree to the combustion of fossil fuels. In its report, the Bruntland Commission noted that "choosing an energy strategy inevitably means choosing an environmental strategy".

Between 1973 and 1986, Canadians "found" twice as much energy through conservation than was added in new oil, gas and electricity supplies. As a result, the amount of energy needed to produce one dollar of GNP dropped by 14 percent between 1973 and 1986. Although substantial, this decrease is only two-thirds of what was realized by other OECD member nations during this same period.

Chapter 1

INTRODUCTION AND BACKGROUND

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INTRODUCTION AND BACKGROUND

1. PUBLIC EXPECTATIONS

It has become commonplace to refer to concern for the environment as the great new political issue of the 1990s. Polls throughout Europe and North America have shown an unprecedented degree of public concern about our environment and a perceived lack of effective political action to protect it. This concern is even spreading rapidly among the elites in the developing world. A recent poll conducted for the United Nations Environment Programme showed very similar results for both developed and developing countries.

The environment has remained at a high level in all the polls for the last three or four years (see Chart A). If the predominant economic issue is inflation or recession or unemployment, the environment may rank second or third for a time. In other years, it may even come first for a prolonged period of time, as it did last year. But it never falls below the first order of public concern. This is leading many of the polling organizations to conclude, as Alain Giguère of CROP told a number of House of Commons committees, that a fundamental and lasting change in values has occurred. [1] This conclusion was reinforced by an Angus Reid poll of 1659 Grade 8 students performed in 1989 for Southam News. [2] The children polled were extremely pessimistic about the future to the extent that environmental catastrophe may be replacing fear of nuclear war as their single greatest concern. This led Reid, perhaps the most conservative of our pollsters to conclude, "The greening of Canada has almost reached the state of a social movement." [3]

This environmental concern was originally driven by one of the strongest human emotions — concern for personal health. This — can I drink the water?, can I eat the food? — phenomenon can pose real problems for public policy. For example, despite repeated assurances by public health authorities and the provincial government that the drinking water of Toronto is perfectly safe, the Crombie Commission reveals that up to a third of the population of the metropolitan area drinks bottled water on a regular basis. According to Synergistics (see Chart B) almost nine in ten Canadians feel that long term health already has been affected by pollution levels in their area. Three-quarters of our population feels that pollution is a major cause of cancer. Perhaps most alarmingly, 85 percent of the population considers pollution problems already serious enough to threaten the very survival of the human race.

Recent polling data from Synergistics indicate that this health worry is being reinforced by two relatively new, and more profound concerns. Canadians seem to be increasingly concerned about the legacy that they are leaving for their children and their grandchildren. The data from fall 1990 polls reveal that 77 percent of Canadians are very concerned about the fate of future generations. And, secondly, there is a growing worry that essential ecological support systems are unravelling. (See Chart C).

When asked who they feel is responsible for this sorry state of affairs, Canadians look to the federal government for leadership. About 30 percent feel that Ottawa should play a primary role in this area. In 1989, only five percent felt that the provincial governments bore prime responsibility. More alarming for Ministers of the Environment is the fact that public criticism of government performance has been growing dramatically, and it started growing even before the latest wave of public distrust in government generally. In 1989, 42 percent rated the performance of the federal government as "poor" (as opposed to 31 percent in 1988 and 20 percent in 1987). Provincial governments fared no better with a 46 percent poor rating as compared with 1988 results of 25 percent and 1987 figures of 15 percent. (See Chart D).

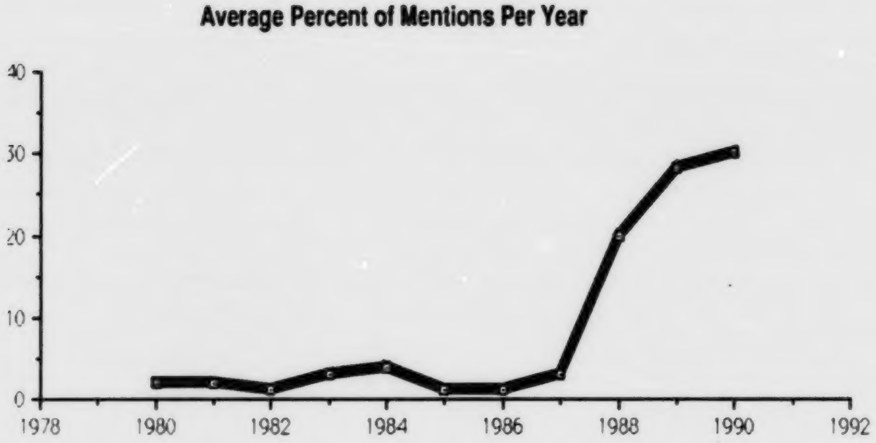
When asked who they trusted to produce reliable information on the subject, Canadians placed a great deal of faith in scientists and environmental groups (51 percent and 41 percent) and little in the federal and provincial governments (13 percent and 11 percent respectively in 1989). Private industry is trusted even less. (See Chart E).

So the pollsters tell us that the environmental issue is here to stay. Policy-makers are thus faced with an aroused electorate, one which is driven by a series of very basic concerns about its own health and survival and that of its children. This volatile mix is made even more unstable by the fact that the Canadian public seems to understand very little about the environmental problems themselves. An obvious example is the inordinate amount of money and time eventually devoted to the PCB problem in the wake of the fire at St-Basile le Grand.

> ***The price of continued success for every business will be actual and perceived corporate environmental responsibility.***
>
> **- J.E. Newall, Chairman, Du Pont Canada, Globe and Mail, June 29, 1990**

Chart A

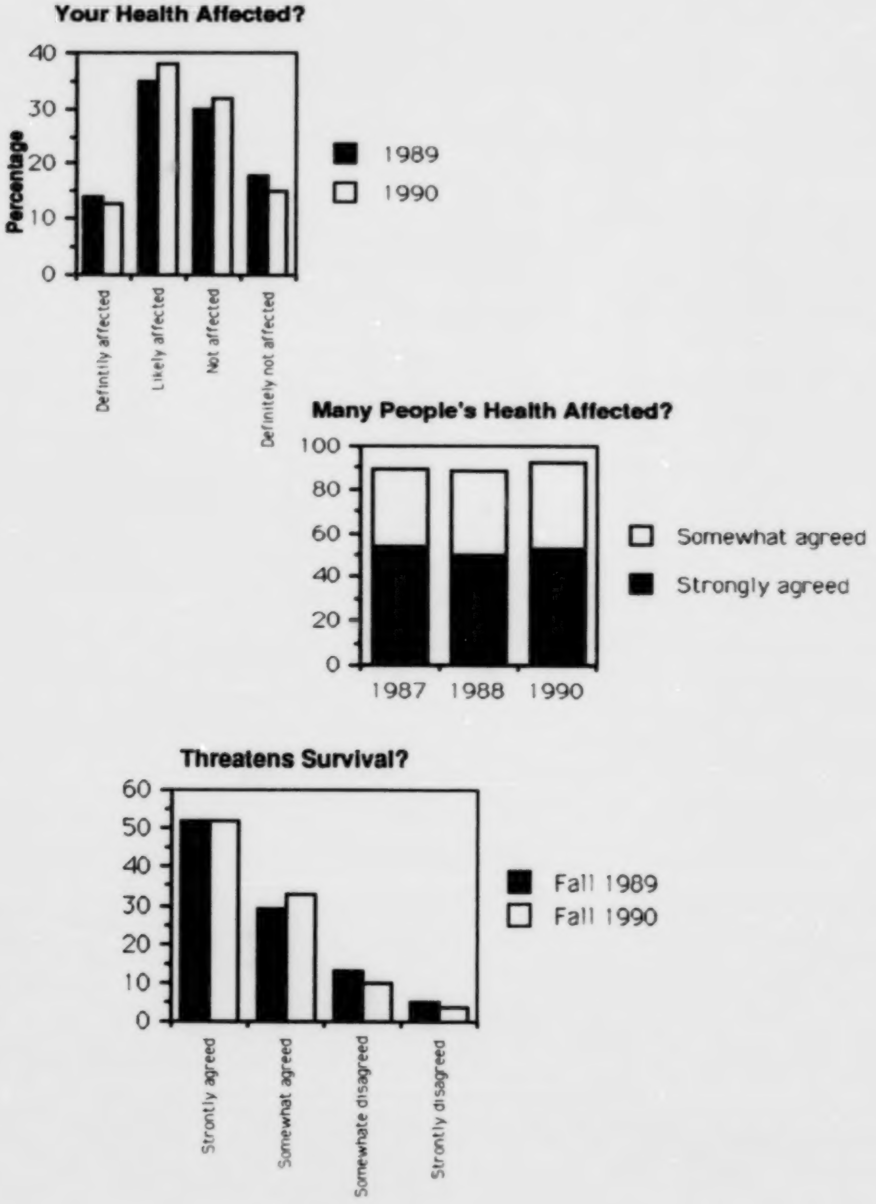
GROWTH OF PUBLIC CONCERN OVER THE ENVIRONMENT



Source: *The Angus Reid Poll*

Chart B

PUBLIC RESPONSE TO IMPACT OF ENVIRONMENT ON HEALTH

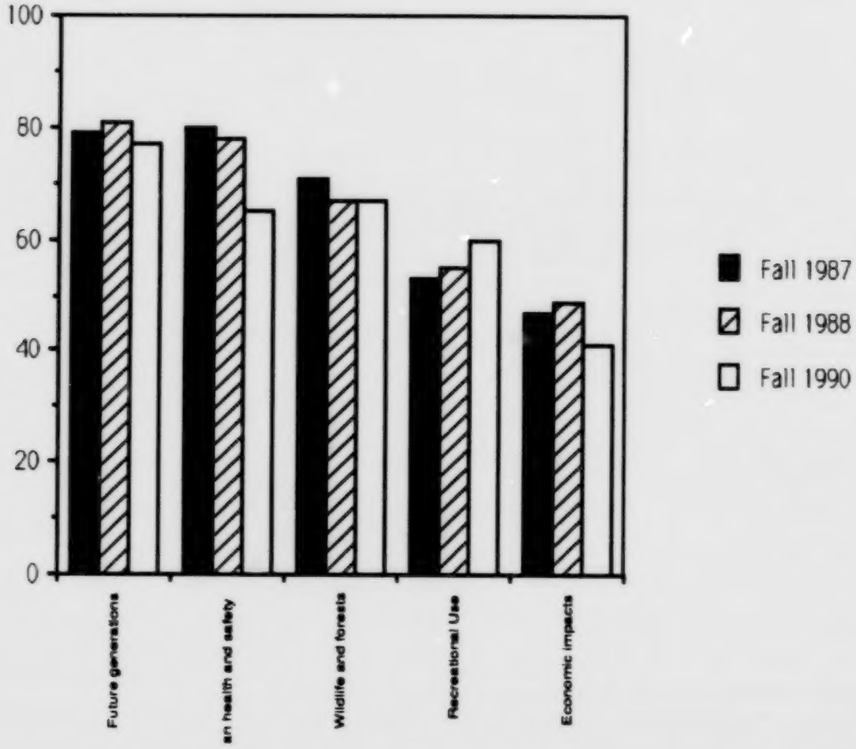


Source: *The Environmental Monitor*

Chart C

CHANGING CONCERN OVER THE ENVIRONMENT

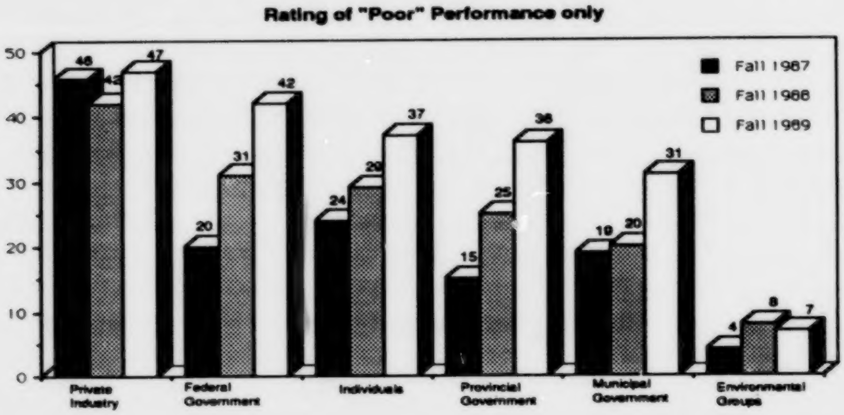
"Very Concerned" Only



Source: *The Environmental Monitor*

Chart D

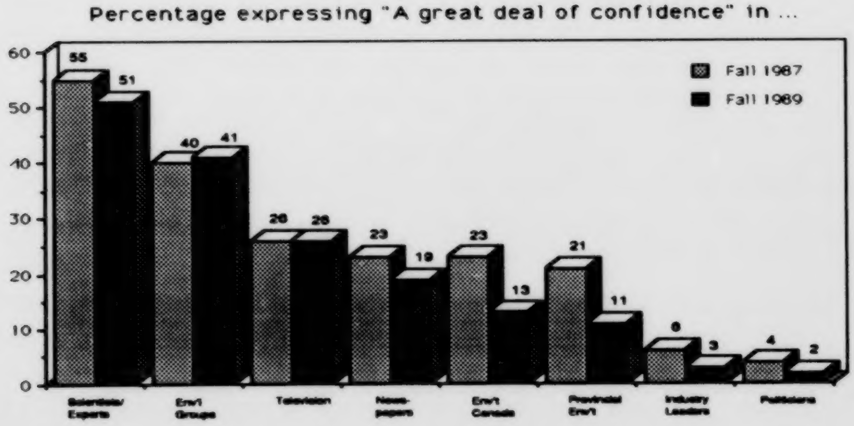
CANADIANS' CRITICISM OF GOVERNMENTS AND THEMSELVES HAS INCREADED DRAMATICALLY



Source: *The Environmental Monitor*

Chart E

SCIENTISTS AND ENVIRONMENTAL GROUPS ARE THE MOST TRUSTED SOURCES OF INFORMATION



Source: *The Environmental Monitor*

The policy choices are made particularly difficult by the lack of a common vision of the environmental future. A recent study of the state of the environment of the Great Lakes by the Institute for Research on Public Policy and the Conservation Foundation of the United States[4] concludes that public policy throughout the region is hamstrung by this lack of consensus about the future. Following the "success" of the clean-up of the lower lakes over the last few years, the remaining choices facing the governments of the region are especially complex. And the costs of these choices vary enormously. To ensure safe drinking water for every municipality in the basin would cost a few billion dollars, spread over a number of years. But to ensure that every beach is open for swimming throughout the summer would cost many billions more, as sewer systems are twinned and treatment plants expanded to deal with stormwater runoff (the costs to Toronto alone are estimated in the $2-billion range). To ensure that all fish are edible, that all beaches are swimmable, that toxic substances cease to be a problem, and that the fishery is a naturally reproducing one (which is what the public seems to want) would cost a staggering amount of money. Some estimates place it as high as $200-billion. There seems to be little public appreciation of the massive sums involved.

The public's initial concern for the environment was almost exclusively local or regional, with occasional reference to national problems. In the 1960s, however, new awareness that pesticide residues were present in the flesh of Antarctic wildlife, that a number of species of whales had nearly reached extinction and that acid rain had become a shocking problem in Scandinavia, made environmental issues international concerns as well.

The 1972 Stockholm Conference on the Human Environment made environmental planning and management a respectable part of the 1970s debate on development and the New International Economic Order. It explored the relationship between environmental decay and poverty, and demonstrated that development strategies must take environmental factors fully into account if their goals are to be achieved. It also led to formal environmental procedures and practices in a number of Third World countries. In the decade following the Stockholm Conference, more than 130 governments established environment departments accompanied by the usual panoply of legislation, environmental impact assessments, training programs and the like.

Yet by the mid-1980s it was clear that the situation had worsened dramatically. The Global 2000 report to President Carter revealed new information about the extent of threats to the "renewable" resource base of the world — deforestation, soil oss, desertification, destruction of watersheds, loss of biological diversity, and the deterioration of the marine environment.

In 1987, the World Commission on Environment and Development took this analysis one step further and demonstrated that the deterioration of natural environment is now becoming one of the principal constraints on development. An essentially open economic system is pressing upon an essentially closed ecological system. In the Commission's view, any domestic or international economic policy which ignores the realities of ozone holes, desertification, deforestation and climate change will be doomed to failure.

Brundtland points out that the traditional compartmentalization of government is at odds with the need to integrate the environment and economic decision-making, and with adequate management of ecosystems as a whole. The new reality will require that central economic agencies be made responsible for the environmental consequences of their actions. It will also require that the old approaches to air, land, and water be replaced in favour of new approaches which treat an ecosystem as a whole.

2. ENVIRONMENT / ECONOMY INTEGRATION

Even before Mrs. Brundtland and her colleagues had finished their task, the Canadian Council of Resource and Environment Ministers (CCREM) reacted to the challenge they posed. CCREM established the National Task Force on Environment and Economy. This group, which included seven ministers, seven chief executive officers (CEOs) of major corporations and trade associations, and a number of representatives from environmental organizations, met several times in 1986 and 1987. The task force recommended that Canada adopt many of the Brundtland recommendations, particularly those related to the integration of environment and economics.

Today, just a little over three years later, the federal government, all provinces and both territories have established Round Tables as recommended by the National Task Force. Most of these Round Tables count economic decision-makers as well as representatives of the environmental community among their members. The Chamber of Commerce has set up regional committees to produce a national report on environment and economy, and the Business Council on National Issues has appointed a committee of CEOs, chaired by the head of IBM Canada, to focus on sustainable development.

The Brundtland Report provides a set of principles to clarify the meaning and implications of sustainable development:

- anticipating and preventing environmental problems;
- making informed decisions that integrate environmental priorities into economic policies and strategies;
- practising full-cost accounting, i.e., incorporating environmental costs into prices;
- living off the interest of natural assets and learning how to do better with less;
- promoting the quality of economic development over quantity or rate of growth.

Of all these principles, the most important involves making economic institutions environmentally responsibie and accountable. This major task will require a fundamental re-orientation of certain dominant methods of decision-making in government and industry as well as on the part of the individuals who buy, consume and dispose of the world's goods. The Round Tables have been charged with developing this new agenda for public policy, integrating the environment and the economy.

3. THE GREEN PLAN

This integration was also to be the goal of the new federal Green Plan, heralded by then-environment minister Lucien Bouchard as a plan to make Canada the world's most environmentally friendly country by the year 2000. Sustainable development is mentioned frequently throughout both the Green Plan discussion material and the final document released by Mr. de Cotret.

The Green Plan is the first comprehensive federal environmental policy in Canada. With allocated resources of $3-billion over five years, its implementation will have major implications for every sector of Canadian society and can be expected to induce large additional expenditures by industry, governments and individuals. The Green Plan's overall goal is "to secure for current and future generations a safe and healthy environment, and a sound and prosperous economy." Within this overarching goal, the federal government has identified several narrower objectives:

- clean air, water and land;
- the sustainable use of renewable resources;
- the protection of special spaces and species;
- the integrity of the Canadian north;
- global environmental issues;
- environmentally-responsible decision-making;
- environmental emergencies.

The Canadian Green Plan is but one of a series of similar plans instigated over the past year or so. Each of them attempts, with varying degrees of success, to incorporate environmental thinking into overall economic policy. Perhaps the most advanced of them all, that produced by the Netherlands, mandates dramatic changes in Dutch energy consumption and waste production, and substantial new government expenditures.[5] The British plan is more descriptive in nature and has been criticized in the U.K. press for containing too few proposals for real action.[6] A French plan is still under discussion.[7]

4. INTERNATIONAL ISSUES

The increased international interest in the environment and sustainable development is leading to speculation that these issues may begin to drive much of the international political agenda for the rest of the century. The environment emerged as an issue on the international agenda at the Stockholm conference in 1972, and the 1992 conference in Brazil (ECO '92) may well entrench it as a major influence on domestic policy.

This could be especially true for a major natural resource and energy producer like Canada. The Montreal Protocol, with the full agreement of the Canadian government, is already influencing domestic CFC policy. Efforts to arrive at an international climate change convention with binding limits on greenhouse gas emissions could have serious implications for domestic energy policy. The creation of an international fund to help developing countries in the transition away from heavy dependence on fossil fuels could have financial implications for Canada's foreign assistance and energy policies.

Canadian forestry policy could also be affected in two ways. First, attempts to include a carbon protocol in any convention could influence our reforestation rate. And secondly, an international forestry convention could contain a number of provisions that would relate to old growth forests, wilderness preservation, reforestation practices and the like. There is a growing worry that a possibility for a consumer boycott of Canadian timber and newsprint exists because of international reaction to Canada's forestry policy. Such a boycott has already been successfully organized by European environmental groups against tropical timber.

5. CONSTITUTIONAL CHANGE

DIVISION OF POWERS

Generally, at the international level, jurisdiction for environmental matters lies with the federal government. It is on the national level, and sometimes the bilateral level, that jurisdiction becomes concurrent and therefore controversial. Because "environment" in the Constitution does not fall under any enumerated head of power (ss. 91 and 92), protection of the environment must be justified indirectly under a variety of related competencies.

The federal government can count upon its express powers and several general powers relating to the national interest, peace, order and good government, interprovincial trade and federal crown lands (including the territories). A province's competence in environmental issues falls primarily within its jurisdiction over property and civil rights, its power to regulate municipalities and its power to enforce valid provincial laws through penal sanctions. These broad powers allow the provinces to regulate the environment on a very practical level, for example: zoning, waste disposal, local commerce and industry, sewers, fresh water treatment, local transportation, air, soil and water quality and governance of the natural resources on provincial crown lands.

It is the areas of express shared jurisdiction, such as agriculture, and those of parallel jurisdiction, such as transboundary air and water pollution, that create conflict. If the goal, however, is the achievement of national standards for pollutants with minimum intrusion upon provincial legislative powers, there are a few flexible solutions.

First, the equivalency provisions of the Canadian Environmental Protection Act, (CEPA), ss. 34 and 63, allow the federal government to set uniform limits for air toxics and international air pollution, while allowing the provinces to promulgate and regulate their own standards if deemed equivalent or better than the national one.

Second, fiscal incentives, such as tax rebates for pollution control equipment, or grants for provincial enforcement of toxics control — provided by the federal government and tied to the achievement of national objectives — can minimize the role that the federal government needs to play in local attainment of environmental objectives.

Third, national, mandatory standards with provincial responsibility for implementation can sometimes allow for both provincial flexibility and for federal assurance that national goals will be met. This alternative has been successfully implemented in the U.S. under the Clean Air Act whereby "State Implementation Plans" are required to meet federal emission standards, on pain of stricter federal regulation of the "non-attainment areas".

And finally, where the federal and provincial governments have been unable to settle differences in areas of shared jurisdiction, such as with motor transportation and the marketing of agricultural products, the delegation of regulatory power to common agencies can resolve jurisdictional conflict.

Jurisdictional conflict may increase in the future as the provinces seek greater control over the environmental issues that affect provincial property and resources. The public may become increasingly impatient with what it perceives to be government inaction masquerading as constitutional posturing on a wide range of environmental threats. As we have seen, the polls reveal that Canadians see the federal government as bearing far more responsibility for environmental action than the provinces; yet both levels of government receive a poor rating for past accomplishments. National standards with provincial attainment strategies provide for cooperative action and may improve public perception as well as environmental quality, while minimizing intrusion by one level of government upon another. The "Statement of Interjurisdictional Cooperation on Environmental Matters" adopted by the Ministers of the Environment in March 1990 provides a framework for intergovernmental cooperation, and bilateral and multilateral agreements among the jurisdictions. Its goals are the harmonization of standards; management of shared natural resources; and the exchange of environmental information.

CCME has already begun work on national standards for the pulp and paper industry and for the creation of a fund to clean up contaminated sites. The latter, known as the National Contaminated Sites Remediation Program, establishes a 50/50 cost-sharing schedule for federal and provincial clean-up of contaminated orphan sites. Environment Canada has pledged $200-million for clean-up and $50-million for technology development to this remediation program. Canada and British Columbia finalized a $29.2-million cooperative clean-up agreement in November 1990. Similar agreements with five other provinces (New Brunswick, Prince Edward Island, Nova Scotia, Alberta and Ontario) are nearing completion.

ABORIGINAL ISSUES

The Constitution Act 1982 recognizes two sources of aboriginal rights. Treaty rights include rights in land claims agreements. Such rights, as recognized in various treaties mostly negotiated in the 19th century, are usually limited in terms of benefits and powers to native people. In contrast, the three land claims agreements concluded to date have not only conveyed land and harvesting rights , but also rights to participate in the management of wildlife and the environment. However, neither the treaties not the claims convey rights to self-government. Except as specifically provided in particular claims agreements, federal, provincial and territorial laws of general application apply to native peoples who live in treaty and claim settlement areas.

The other source of aboriginal rights is existing aboriginal rights. The nature of these rights, however, is unclear. The First Ministers Conferences, called for by the Constitution Act 1982, have failed to define them.

Two recent Supreme Court decisions, Guerin v. R. and R. v. Sparrow, indicate that native claims to self-governance, as supported by existing aboriginal rights, will be taken seriously by the judiciary. In Guerin , the court qualified the relationship of the federal government to native lands as a fiduciary one. The historic powers and responsibility assumed by the Crown over native issues was the source of this fiduciary obligation. In Sparrow, the court took this relationship one step further to affirm the primacy of aboriginal rights as defined in Section 35(1) of the Constitution Act 1982, to the extent that Canadian legislation — federal or provincial — cannot infringe on these rights in the absence of a two-fold justification. First, is the infringement due to a valid legislative objective, such as conservation and resource management? And if so, then does the infringement respect the special trust relationship of the Canadian government towards native peoples? The specific issue in Sparrow was whether the aboriginal right to fish could be curtailed by federal resource management regulations setting maximum net size for fishing. This infringement on existing native rights was ruled invalid. The decision requires that governments justify legislative interference with aboriginal rights. This presumably includes legislation that is protective of the environment as well as legislation which promotes development.

Chapter 2

INTERNATIONAL ISSUES

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INTERNATIONAL ISSUES

GLOBAL ISSUES

In 1984, the United Nations appointed a commission, chaired by Gro Harlem Brundtland, the Prime Minister of Norway, to examine the relationship between environment and development. The Commission had 23 members from all regions of the world. It was composed largely of people who had held positions of political or economic power in their own countries, many of whom had little or no environmental background. It is therefore remarkable that the Commission produced a unanimous and hard-hitting report: Our Common Future, published in 1987.

The Commission began its report by examining the global environmental trends of the 1980s:

1) Each year over six million hectares of productive dryland turns into desert — over 30 years this would amount to an area roughly the size of Saudi Arabia. At this moment, an area of Africa equal to the size of India is subject to such desertification.

2) The world is losing more than 11 million hectares of tropical forests annually (since the publication of the report, this figure has risen to 17 million). Over three decades this would also equal an area the size of India. Already the Food and Agriculture Organization (FAO) estimates that more than one billion people are suffering a shortage of firewood — the basic fuel for most of Africa — because of this deforestation.

3) The use of certain chemicals — principally of CFCs and halons — is gradually destroying the earth's ozone shield.

4) Owing to vast increases in the burning of fossil fuels, we have already initiated a series of changes in the world's climate. Scientists from the Intergovernmental Panel on Climate Change estimate that these changes, if left unchecked, could result within the next forty years in temperature increases of 0.3 degrees centigrade per decade, rises in sea levels of up to 1/2 meter and major shifts in world rainfall patterns.

5) Despite some birth control progress in some countries, the world population will inevitably grow to around ten billion — roughly twice its present size — and result in huge, unprecedented, claims on resources.

6) The Commission reminds us that this unprecedented growth in human numbers is being accompanied by equally unprecedented increases in industrial production. It has grown by more than 50 times over the last century. And 80 percent of this growth has occurred since 1950.

7) We have increased our use of fossil fuels, (principally oil and coal) by more

than 30 times in the last 100 years. A full three-quarters of this increase has come since 1950.

8) We have produced a huge quantity of man-made chemicals since the war, many of which are now in the environment. In addition, industry produces millions of tonnes of hazardous wastes which must be disposed of safely.

Despite this pessimism over the state of the world's environment, the Commission recognized that a five- to ten-fold expansion is needed in the world economy to meet the inimum needs and aspirations of the 10 billion people who will be on the planet by the middle of the next century.

An expansion on this scale is at odds with the environmental observations enumerated above. The growth in energy consumption alone would make the problem of climate change virtually unmanageable. The Commission could have thrown up its hands in despair. Instead, it produced a new and useful concept — sustainable development. In the Commission's own words, sustainable development involves meeting today's needs without seriously endangering the prospects of future generations.

Nearly 40 percent of the earth's land-based photosynthetic activity is devoted to the satisfaction of human needs or has been lost as a result of human degradation of natural systems.

- Worldwatch Institute, State of the World, 1990, page 7

Since the publication of the Commission's report, the issue has moved speedily to the top of the international agenda. The United Nations has begun preparations for a conference on environment and development to be held in Brazil in 1992, the Montreal Protocol on substances which deplete the ozone layer has been strengthened, and preliminary negotiations have begun on climate change, forestry and biological diversity conventions.

1. OZONE DEPLETION

A classic success story in international cooperation has been the effort to strengthen the Montreal Protocol and thereby protect the ozone layer. The protocol, first negotiated in Montreal in 1987, seemed afterwards to be in trouble. Few countries ratified the document until Mrs. Thatcher convened a meeting in London in the spring of 1989. That meeting, and subsequent meetings in Helsinki, resulted in an increased number of signatories and a significant strengthening of the protocol's provisions. Broadly speaking, the final document ensures that production of CFCs in developed countries will be phased out by the end of the century, rather than being halved, as was the case in the previous agreement. Two additional substances were also added to the agreement.

The resolution of the issue also called for some form of burden sharing, to ensure that large developing countries, such as India and China, signed the document. These countries have ambitious plans to provide refrigerators to their vast populations — a goal that is difficult to fault. Why, they reason, should they cut back on their plans or pay a hefty additional price for expensive CFC substitutes?

This led to a proposal, presented at the second London meeting in June 1990, for the creation of a fund to ease the transition away from CFCs in the developing world. The fund, to be established at a level of approximately $100-

million per year was initially resisted by the United States, fearing the precedent it might create for a larger fund to deal with global warming. The United States eventually agreed to go along with the fund at a level of $280-million for the first three years. The protocol was strengthened to call for a ban on the production of CFCs by the year 2000 and India and China both indicated their willingness to reconsider their positions and to sign the protocol.

Since the London meeting, progress has been rapid. Agreement has been reached on the establishment of an interim secretariat in Montreal. Mr. de Cotret reports that Canada is well ahead of the revised timetable for phasing out CFCs and a Canadian technical assistance team sent to Malaysia feels that the phase-out in many developing countries may also go more smoothly than expected.

2. CLIMATE CHANGE

The major issue to emerge on the international scene is global warming. Briefly put, global warming results from an increase in the concentration of a number of greenhouse gases (GHGs in international negotiating terms) in the earth's atmosphere. Although media and public attention has focussed on carbon dioxide (CO2), CFCs and methane are also potent contributors to climate change. With the fourth highest per capita production of such gases (resulting from human activity not natural processes), Canadians have a particularly important responsibility in this problem area. Since land masses at higher latitudes are expected to experience 2-3 times the level of mean global warming, Canada could be affected to a far greater extent than many other nations.

The issue first appeared on the public agenda at the Toronto Conference on the Changing Atmosphere. The Conference, held in 1988, brought together over 300 scientists, policymakers and representatives of non-governmental organizations (NGOs). Its statement began with the following paragraph:

> *Humanity is conducting an unintended, uncontrolled, globally pervasive experiment whose consequences could be second only to a global nuclear war. The Earth's atmosphere is being changed at an unprecedented rate by pollutants resulting from human activities, inefficient and wasteful fossil fuel use and the effects of rapid population growth in many regions. These changes represent a major threat to international security and are already having harmful consequences over many parts of the globe.*

The Conference called for a reduction in CO2 emissions by 20 percent by 2005. It also called on countries to establish a World Atmosphere Fund to help the developing countries ease their transition from heavy dependence on fossil fuels. The Canadian Ministers of Energy have met twice since the Toronto conference to discuss formally the question of a Canadian commitment to curb CO_2 emissions. CCME is also developing a national action strategy on this subject.

The Intergovernmental Panel on Climate Change (IPCC), a group of the world's leading climate scientists, has concluded that the earth faces significant temperature increases over the next fifty years, perhaps greater than those which have taken place over the last 10,000 years. IPCC also concluded that the sea level in places would rise by one-half a metre. The exact consequences of this warming are unknown, but it and the rapid shift of climate zones will result in major shifts in rainfall patterns, massive flooding in some low-lying countries, increased frequency of tropical storms and unpredictable changes in agriculture and forestry. These shifts would be so rapid that many plant and animal species would not survive.

The IPCC report formed the scientific background for the Second World Climate Conference recently held in Geneva. The Conference agreed to begin negotiations on a binding agreement on climate change in February, 1991 with a view to producing a draft for discussion at the United Nations Conference on Environment and Development in Brazil in 1992. An international agreement is likely to take longer to negotiate.

If the international negotiations are to be successful, all developed countries will need to agree to some cuts. The Toronto Conference suggested an interim goal of 20 percent. The IPCC report emphasized the interim nature of even the 20 percent cut, reiterating that a 60-80 percent cut would eventually be necessary to stabilize the levels of CO2 in the atmosphere. In order to be successful, any climate change convention will need to make special provisions for the developing countries. Commercial energy use in almost all of these countries is at extremely low levels and will need to be raised if these countries are to improve their standards of living. But herein lies a danger. If India and China, for example, pursue their present plans for industrialization, they could add up to 200 additional coal-fired generating stations within the next few decades. The CO2 emissions from these facilities would likely wipe out any savings realized by the industrialized countries.

This situation has led to calls for a substantial fund to help ease the transition to more efficient forms of energy production and utilization and to enlarge the "carbon sink" contained in the world's tropical forests. The Toronto Conference called for such a fund and the ozone negotiations could provide a precedent. The financial requirements of such a fund would be substantial — an official Dutch Government study puts it at $40- to $60-billion annually.

Although no formal international targets have been set, a number of countries have taken unilateral action. The Federal Republic of Germany has adopted a target of reducing emissions by 25 percent over 1987 levels by the year 2005; the Netherlands has agreed to a freeze by the mid-1990s with a cut of five percent by the year 2000; Denmark and New Zealand will attempt to reduce emissions by 20 percent by 2000. The Canadian position, reaffirmed by the reen Plan, is to freeze emissions at 1990 levels by the year 2000.

Controlling emissions of greenhouse gases has obvious ramifications for a major energy producer like Canada. Although we produce only two percent of the world's emissions of CO2, we are the largest per capita producer of greenhouse gases in the industrialized world. We are also perhaps the OECD's least efficient consumers of energy per capita and per unit of GNP. Canada is a large and cold country with a large proportion of energy-based primary industries. We are also a large energy exporter. This raises questions of the CO2 content of exports.

Table 1

INTERNATIONAL COMPARISON
Anthropogenic Additions to the Carbon Dioxide Flux
1987

COUNTRY	THOUSAND TONNES CARBON	CO2 PER CAPITA
Canada	110,100	4.3
United States	1,243,800	5.0
United Kingdom	156,900	2.8
France	94,200	1.7
West Germany	181,400	3.0
Italy	101,900	1.8
Japan	247,524	2.1
World	8,490,000	1.7

SOURCE: World Resources Report, 1990-91. Washington: World Resources Institute

The Green Plan proposes the beginnings of a national strategy for CO2 limitation. In the absence of these concrete actions to curb emissions, it predicts a 17 percent increase in Canadian emissions of CO2 by the year 2000. The strategy calls for:

- the introduction of a National Energy Efficiency and Alternative Energy Act, to regulate minimum energy efficiency levels and labelling of products to convey information on energy use
- updating and regionalizing the national measures for energy conservation in buildings and their incorporation into building codes
- the development of fuel efficiency targets for new vehicles
- a federal-provincial partnership to develop strategies for reducing CO2 emissions from transportation
- accelerated development and market penetration of alternative transport fuels
- increased research and development for new and renewable sources of energy.

According to Mr. de Cotret, this strategy at best will produce about 60 percent of the emission savings required. Governments will then be faced with some of the tougher and more unpalatable alternatives such as carbon taxes, other increases in energy prices, and the potential role of nuclear power as an alternative source of supply.

This debate will soon be conducted in the open during the hearings on Ontario Hydro's long term energy supply and demand strategy. Public funding for intervenors will ensure that all of the alternatives are spelled out in some detail.

In addition to their potential for driving the domestic Canadian energy agenda, the climate change negotiations may have a major effect on Canadian foreign policy. Historically, our foreign assistance policy has concentrated on helping the poorest countries. If this policy turns in the direction of countries with the greatest effect on global change, then many of the poorest countries could be left out in the cold. Eight large developing countries produce over 75 percent of the Third World's emissions of greenhouse gases; funds devoted to climate change will be targeted at them. And relatively few countries account for the vast majority of the earth's remaining tropical forests; assistance in the form of debt swaps and reforestation schemes will clearly be targeted at them.

3. FORESTRY

Another issue driving the international debate is tropical deforestation and species extinction. Although linked to the climate change discussions through their potential as "carbon sinks", forests (in the opinion of many) also need to be discussed on their own, especially in the light of the recent conclusions by FAO that the rate of deforestation has jumped to 17 million hectares per annum. This argument holds that forests perform a range of functions, providing employment to forest dwellers and loggers, acting as carbon sinks, providing the most diverse ecosystems known to mankind, and supplying a whole range of valuable services from climate moderation to water management. Of all the issues on the agenda, nothing has affected public opinion as much as the realization that the world's main repositories of genetic diversity and untold natural wealth are disappearing at a frightening rate. This led the G-7 Summit in Houston to propose a world agreement or convention on forestry, to be prepared in time for the 1992 Conference in Brazil. Canada has been one of the most active proponents of the need for such a convention.

The World Resources Institute and a number of United Nations agencies also have been developing a possible convention on biological diversity, ready (it is hoped) for signature at the 1992 meeting.

It is not at all clear how these issues will resolve themselves, but it seems reasonable to assume that we will not have a forestry protocol to the climate convention, a world forestry convention plus a convention on biological diversity by 1992. What is clear, however, is that these are critical issues for Canada, the world's biggest exporter of forest products. What happens at the 1992 Conference and in the negotiations over the respective conventions involving forestry will be of critical importance to that industry.

Canada has excellent credentials to bring to the table. The industry is sophisticated and technologically competent. CIDA, our national aid agency, has long been one of the leading supporters of forestry activities internationally. Its total commitment to international forestry co-operation and related initiatives through all channels is approximately $1-billion. Annual commitment levels are at about $350-million. CIDA has also been a leader in the development of the Tropical Forestry Action Plan, which has succeeded in more than doubling the amount of foreign assistance to forestry in developing countries.

But Canadian influence on the outcome of these critical discussions will be directly related to the outside world's perception of our domestic forestry policies. This perception is very poor at the moment. The criticisms may well be unjustified and overdone: many in the industry maintain that it is reformed and its silviculture practices are improved. But the Canadian public and media do not seem to believe these assertions and the skepticism has spread to other countries. This may well reduce our influence at the international bargaining table and lead to proposals for boycotts of Canadian forest products in European and American markets. Such boycotts have been remarkably successful with other traditional Canadian products. And there is an even stronger precedent: European environmental groups have effectively opposed recent imports of tropical timber.

4. LONG RANGE TRANSPORT OF AIR POLLUTANTS

The long range transport of airborne pollutants (LRTAP) is an issue with an international cause and local effects. Many substances remain in the air to be transported around the world and transformed into threatening substances such as acid rain, oxidants and polycyclic aromatic hydrocarbons. Some gases, such as carbon dioxide and freon are transported throughout the lower atmosphere, while industrial emissions from the Soviet Union and Europe have been found in the Arctic.

Concern for acidic air pollutants led to the 1979 Economic Commission for Europe (ECE) Convention on Long Range Transboundary Air Pollution and a protocol for international monitoring and assessment. In 1985, the ECE was responsible for the Helsinki Protocol which addresses transboundary flows of sulphur dioxide. The Helsinki Protocol was an important international recognition of the trans-boundary transport of toxics and the need to exert international pressure to achieve a remedy. The Protocol commits signatory countries to reduce sulphur dioxide emissions by 30 percent. In 1988, Canada and the United States signed the Protocol, along with other member nations of the UN Economic Commission for Europe, committing to a freeze of nitrous oxide (NOx) emissions at 1987 levels, in addition to the limit on sulphur dioxide. Other provisions of this Protocol include: a commitment to use the best available control technology on new sources; the exchange of information on such control technologies and increased availability of unleaded gasoline in Europe.

In Canada's Green Plan, the federal government states its intention to press for renegotiation of the Helsinki Protocoland to pursue a protocol to futher manage emissions of volatile organic compound (VOC) emissions.

The Great Lakes are particularly susceptible to air toxics because of their vast surface area and location in the path of prevailing winds. Several of the major toxins deposited in the Great Lakes are known to biomagnify in the fish and birds of the lakes, posing increased health risk to the humans who consume them. According to a recent study by the Institute for Research on Public Policy and the Conservation Foundation, more than half the toxic substances found in Lake Superior and a number of the other lakes come from airborne sources. For example, DDT, a critical pollutant long banned in North America, is still being deposited in the Great Lakes basin. The origin of this DDT has been attributed to Central and South America. The effects of this long range transport are primarily a worsening of air quality, acidification of lakes, disruption of the food chain and a rising level of nitrates in drinking water.

5. ECO '92

The United Nations Conference on Environment and Development (ECO '92) will be held in Brazil in 1992. In addition to climate change and forestry, the Conference is expected to discuss the full range of environment and development issues.

The discussions so far have centred on the relative weight to be assigned to those issues given high priority by the developed world vis-à-vis those of greatest interest to developing countries. The former tend to favour issues such as climate change, deforestation, the loss of biological diversity and threats to the marine environment. The developing world, on the other hand, senses that the global nature of these issues may finally give them some leverage in a negotiation with the rich countries. They are trying to use that leverage to focus attention on their issues of debt, trade, poverty and the flow of financial resources between North and South.

The Secretary-General of the Conference is a Canadian, Maurice Strong. His strategy at this point is to force the issue up to the highest levels of government. The General Assembly has approved his plan to have at least part of the Conference devoted to Heads of State or Heads of Governments. This may mean an unprecedented "summit" of up to 100 Presidents and Prime Ministers. Strong also is lobbying to have governments treat this Conference as one whose focus is on economics and economic policy as much as it is on the environment. This is consistent with the philosophy of the Brundtland Commission.

The ECO '92 Conference may well provide a unique opportunity to bring all of these issues together at the Cabinet level and to begin the process of constructing what some have referred to as a global bargain. This bargain would involve trading concessions from the developing world on CO2 emissions and deforestation for Northern ones on technology transfer, debt relief and the establishment of a fund to help developing countries adopt new energy technologies.

Any Canadian position must first of all come to grips with the questions of technology transfer for low impact energy technology and the establishment of appropriate financial arrangements for the developing countries. Both of these questions fall almost exclusively within federal responsibility and need not necessarily concern the CCME.

Most of the other critical issues will, however, be of interest to the provinces. First, there is the issue of global warming and Canada's position on CO2 limitations. The negotiations on a World Climate Convention should be at an advanced stage by then, and the issue of CO2 reduction targets will need to be resolved. Second, the federal government is pushing very hard for the new world forestry convention; many of its provisions will be of critical interest to provincial governments. The final convention relates to the preservation of biological diversity and is bound to contain provisions related to the management and preservation of old growth forests, and to the creation of new parks and protected areas.

Our domestic policies on energy and forestry and a host of other natural resources could be affected, along with our international competitiveness. In formulating the Canadian position for UNCED, the federal government will be looking to the provinces for advice in areas of provincial competence. A very active committee of national development and environmental NGOs has already been established and is pressing for an elaborate public consultation exercise to develop the Canadian National Report for UNCED, one of the key documents in the process. It is even possible that this consultation exercise could involve the NGOs and the House of Commons Committee on the Environment as a kind of Royal Commission.

6. MARINE ENVIRONMENTAL QUALITY

POLLUTION FROM SHIPS

The chairman of the Public Review Panel on Tanker Safety and Marine Spills Response Capability noted in his report how "shocked the panel was by the extent to which our coastal and inland waters are polluted". The panel found that each year Canada can expect over 100 small oil spills, about ten moderate spills, and at least one major spill. A catastrophic spill (over 10,000 tonnes) can be expected once every 15 years. In environmentally sensitive areas (Arctic and many coastal regions) even a small spill could be disastrous. Liver disease found in marine mammals caught off Tuktoyaktuk seems to be correlated with high levels of contaminants in the area. The chairman stated that "a major spill in these areas would be one of the greatest environmental catastrophes this country has ever seen.

The Panel found that over 350 chemical spills occur in Canadian waters every year. The environmental and health hazards they pose are largely unknown and, where clean-up is possible, they often cost 10 times as much, and take five times as long to clean as oil spills. The Panel concluded that "the capacity to respond effectively to a spill of any significant magnitude does not presently exist anywhere in Canada." Although prevention of spills should be the first priority, the Panel recognized that not all spills could be prevented. The Panel therefore recommended that Canada's spill response capability be vastly improved.

Of more immediate importance, the Panel found that a much greater volume of oil enters the marine environment as a result of routine tanker operations (loading and offloading, tank washing, and wastewater discharges) than accidents, and almost all of those operational spills can be avoided, with comparably insignificant costs to industry and government. As well, foreign tankers were found to pose a greater threat to our shores than domestic tankers. Almost one-quarter of the foreign tankers inspected by the Canadian Coast Guard in the Atlantic region were found to be defective.

Ocean dumping is another source of pollution from ships. Canada is not involved in the large scale dumping of industrial waste and sewage sludge that the London Dumping Convention is intended to control, but wastes dumped off other nations' shores can contaminate Canadian waters. It is important therefore for Canada to continue to be a strong proponent of such international controls.

POLLUTION FROM LAND-BASED ACTIVITIES

Canadians contribute many pollutants into our coastal waters from land-based activities. We discharge biodegradable pollutants, such as raw sewage and food processing wastes, that reduce oxygen levels. We use large quantities of chemical fertilizers and pesticides on our cropland. These chemicals can wash into waterbodies, degrading the ecosystem and contaminating the food chain. We also discharge smaller quantities of more toxic chemicals into our waterways, which are immediately lethal and/or accumulate in the food chain, causing cancers and reproductive failure in fish, birds, and mammals. Pollutants discharged into inland waterways travel downstream to eventually pour into the sea. Scientists have found levels of persistent chemicals in the flesh of resident Beluga whales high enough to qualify these animals as hazardous waste.

Progress in this area awaits progress on the issue of sewage disposal plants, mentioned later in this report. The Green Plan contains measures affecting two of the major rivers in Canada which enter coastal waters — the St. Lawrence and the Fraser. And a previous collaborative agreement between Ottawa and Nova Scotia is designed to help clean up Halifax harbour.

7. CIRCUMPOLAR COOPERATION

If you look at the Arctic Ocean on a circumpolar map, you will see that it is really an international lake. All of us have an obligation to ensure that this international lake is protected. I suggest that we should not, in Canada, engage in noisy assertions of sovereignty. Sovereignty should not define our policy. I urge instead that we take the lead in introducing proposals for circumpolar cooperation.[8]

The circumpolar Arctic has become a depository for contaminants and hazardous wastes from the industrial world. Dangerous levels of toxins, including PCBs, dioxins, pesticides and heavy metals, are found in the Arctic food chain. The Canadian north alone contains over 800 sites in which there are hazardous or dangerous materials. There is mounting concern over industrial development in northern watersheds and offshore areas.

In response, the federal government will shortly announce its domestic Arctic Environmental Strategy, a five year initiative which, according to Canada's Green Plan, is intended to achieve sustainable development in the Canadian Arctic. The major elements of the Strategy include dealing with Arctic contaminants, managing waste in the north, improving northern water quality, expanding research and information services, integrating environmental and economic issues, and protecting Arctic ecosystems.

Over the past year and a half, Canada and the other circumpolar countries, have been working toward an international Arctic Environmental Strategy, a process initiated by Finland. The priority items for international consideration include heavy metals, chlorinated organics, radioactivity, oil pollution, acidification of Arctic regions, underwater noise, and monitoring.[9] It is expected that an international agreement will be signed sometime this year.

8. INTERNATIONAL TRADE

In an increasingly interdependent world, no country's environmental policy can remain too far out of step with that of its major trading partners without imposing economic costs. This argument has been used to oppose unilateral Canadian action on a variety of environmental issues, including a CO2 emission reduction program. It should be noted that Canada has already suffered some consequences of an international perception of its resource management practices as being environmentally unsound: the European Community's ban on the importation of seal pelts, the international anti-fur campaign, the softwood lumber and East Coast lobster disputes with the United States are examples of trade actions taken by foreigners against Canada at least in part for environmental reasons. Without passing judgement on the merits of any of these actions, the views of Canada's trading partners can be expected increasingly to influence Canadian environmental policy. Areas where Canada is potentially vulnerable include the James Bay II development and forestry practices.

BILATERAL ISSUES

1. ACID RAIN

In Canada, the effects of acid rain have damaged approximately 150,000 lakes, with 14,000 already considered "dead". Increased acidity in precipitation can also make other components such as aluminium, copper and mercury in untreated water even more toxic. More than 15 million hectares of forestland receive high levels of acid precipitation. An increase in human respiratory problems is also attributed to acid rain. Estimates place the annual costs of acid rain to the Canadian economy at a minimum of $1-billion per year.

In 1980, Canada and the U.S. signed a Memorandum of Intent concerning Transboundary Air Pollution. Although the scope of the Memorandum covers all air toxics, to date, the area of concentration has been the precursors to acid rain. Another vehicle for bilateral cooperation in this area is the Great Lakes Water Quality Agreement. The Great Lakes region has suffered the harmful effects of acid rain and the infrastructure established under this Agreement favours joint research and negotiation.

In 1985, the Canadian government created the "Canadian Acid Rain Control Program" to cut emissions of nitrogen and sulphur oxides. Under agreements between the federal government, the seven eastern provinces and industry, the goal for reducing emissions is currently to cut total sulphur dioxide emissions back to one half the 1980 levels by 1994. Under these agreements, each province is to implement abatement programs with targets and schedules for local industries. The costs of research and development and implementation of cleaner technology are shared between the federal and provincial governments. Already, emissions have dropped by 40 percent and it appears that the 1994 target will be met. This emissions reduction goal will become permanent. The Green Plan commits Canada to cap its acid rain-related emissions in eastern Canada through 1997 through extended federal-provincial acid rain control agreements. In addition, the government will expand the Control Program to establish a national emission cap for the year 2000. The CCME has already agreed to establish such a cap at 3.2 million tonnes for sulphur dioxide in the year 2000.

The most recent progress in the United States are the 1990 amendments to the Clean Air Act. Under the amendments, SO_2 emissions from electric utilities will be reduced by 10 million tonnes by 2000 and permanently capped at the reduced level. A system of tradable emission permits is being used to implement this program. SO_2 emissions from industrial sources are being capped at 5.6 million tonnes beginning in 1995. NO_x emissions from power plants are being reduced by about two million tonnes by 2000. The market mechanism of the Clean Air Act amendment is discussed in the environment-economy integration chapter of the next section. Cleaner gasoline will be required in the nine U.S. cities with the worst ozone pollution, by 1995. Auto manufacturers will be required to reduce tailpipe emissions of NOx by 60 percent for 40 percent of the vehicles sold by 1994 and for 100 percent of vehicles sold by 1998. The implementation of these amendments will have a positive effect on the Canadian environment. A federal study has estimated that the proposed reductions in SO2 emissions, however, will only allow about nine percent of acidified lakes to recover.

2. AIR TOXICS

Because of the amount of attention that acid rain has received in North America, other forms of transboundary air toxics have not received their proper share of attention. Unfortunately, these other toxic and oxidant air pollutants pose an equally serious threat to human health and ecological welfare. Many of these chemicals share two characteristics which make their emission in even small quantities a matter for bilateral concern: persistence in the environment and bioaccumulation in the food chain.

In the U.S., national emission standards have been set for oxides of sulphur and nitrogen, lead, VOCs, suspended particulate matter and carbon monoxide. The U.S. Clean Air Act creates a single program for the control of all these substances, defined as "hazardous" under the Act. These standards are then implemented by state programs.

In Canada, toxic air pollutants are regulated by the Canadian Environmental Protection Act. Substances on CEPA's Priority Substances List can be controlled by regulations issued under the Act. Unfortunately the common toxics of urban and industrial air pollution do not appear on the list. However, the Green Plan contains a commitment to implement the ten-year federal/provincial management plan, adopted by CCME in 1988, to reduce NOx and VOC emissions in problem areas by up to 40 percent by the year 2000. The federal Ministers of Transport and the Environment have announced that the California Air Resources Board standards for hydrocarbon, CO and NO_x emissions will be phased in with the 1994 model year and be fully implemented by the 1996 model year. The federal government also commits itself to negotiate specific emission reduction obligations with the U.S. under the Transboundary Air Quality Agreement. (An agreement was concluded in March 1991.)

3. NORTH AMERICAN WATERFOWL MANAGEMENT PLAN (WETLAND CONSERVATION)

Millions of hectares of North American wetlands have been drained for agricultural purposes or to make room for industrial and urban expansion. Biological diversity has been greatly reduced by upsets to biological cycles and the elimination of habitat for hundreds of wetland-dependent plant and animal species, some of which are now threatened with extinction. As a consequence, natural groundwater purification and flood control systems have also been disrupted thus contributing to a growing crisis in water quality. Steeply declining populations of waterfowl have diminished recreational opportunities for bird-watching and hunting, the latter a $2-billion enterprise in Canada and the United States. Total economic benefits of Canada's wetlands are estimated o be in excess of $10-billion each year. Previous attempts to ensure the protection of these valuable wetland ecosystems have met only limited success.

Most regions of Canada, as well as parts of the United States, contain an abundance and diversity of wetland ecosystems. Wetland basins collect and store runoff, thereby replenishing aquifers and ground water needed to sustain natural vegetation, crops and wildlife. Wetlands play a role in purification of water supplies, prevent soil erosion, moderate regional impacts of droughts and floods, and provide habitat for 37 species of waterfowl as well as many other species.

Since the early part of the 20th century, large scale alteration of the wetland base has occurred through widespread drainage for agricultural purposes, urbanization, and various industrial activities. The most apparent effect of these wetland losses has been a long term decline in some important waterfowl populations. This was a major factor which led to the Convention for the Protection of Migratory Birds, established between the United States and Canada in 1916 to ensure the conservation of migratory birds.

The Convention provides the basic foundation for cooperative waterfowl management programs within, and between, the two countries. Although the majority of such programs were concerned with population and harvest management, the focus gradually broadened to include measures for the protection and enhancement of the remaining wetland habitats.

The 1986 North American Waterfowl Management Plan (NAWMP), co-signed by the Minister of the Environment for Canada and the Secretary of the Interior of the United States, brings together international teams of federal, provincial, territorial and state agencies, and private conservation organizations and individuals. The Plan currently extends to the year 2000 when 2.4 million hectares of quality waterfowl habitat (with a minimum of 1.5 million hectares located in Canada) should be protected. This would assure 1970 production levels of ducks, geese, and swans. To date, only five percent of these wetlands have come under the protection of the NAWMP.

Financial requirements to meet these objectives are considerable. The U.S. government, through the North American Wetlands Conservation Act (1989), has undertaken to direct up to $30 million of federal funds annually to North American wetland conservation projects. The Canadian government dedicated $30-million over a five-year period ($6-million per year, 1989-94). This fund is to be matched by provincial and territorial contributions, and then matched again by such conservation organizations as Wildlife Habitat Canada and Ducks Unlimited.

4. THE GREAT LAKES

In spite of all the attention, Great Lakes pollution problems persist. This vital freshwater bioregion is home to 35 million people in Canada and the United States and provides drinking water for two-thirds of them. The latest comprehensive study conducted by the Institute for Research on Public Policy (IRPP) and the U.S. Conservation Foundation, the State of the Environment of the Great Lakes, details serious and growing problems.

The problem is in two parts. First, historic deposition of persistent pollutants like PCBs and heavy metals such as lead, clog the ecosystems of many areas of the Great Lakes. Windermere Basin in Hamilton Harbour and the St. Clair River downstream from Detroit and Windsor are two examples. Second, ongoing current-day depositions continue to threaten the lakes' water quality with both biological and toxic chemical pollutants. These include the mixed biological and chemical discharges from the Ashbridge Bay Sewage Treatment Plant in Toronto and chemical plant discharges to Saginaw Bay, Michigan.

In addition to the point source discharges, there are non-point source discharges involving farmland run-off containing chemical fertilizers and pesticides, and chemical and biological leachate migrating from abandoned dumps. Toxic fallout from the industries in and beyond the Great Lakes basin adds tens of thousands of tonnes of chemicals and heavy metals to the lakes from the air. One International Joint Commission study estimated 64,000 tonnes of toxics and heavy metals fall on Lake Ontario annually. One of the major sources of PCBs and certain pesticides in the Great Lakes is toxic fallout.

There have been some successes in cleaning up the discharges to the Great Lakes. Lake Erie was brought back from the brink of death. Eutrophication processes starving the lake of its life-giving oxygen were reversed. A major program in the 1960s and 1970s to reduce biological discharges met success.

For the whole of the Great Lakes, over $10-billion has been spent by the United States and Canada on building and improving municipal sewage treatment plants. But this expenditure has been insufficient to keep up with the industrial growth in the region and the discovery that many chemical discharges are just as harmful and need to be eliminated. The connecting river hotspots will again be a major focus, in particular the Niagara River with its historic toxic waste sites and the St. Clair River which is the recipient of millions of gallons of wastewater from Canada's Chemical Valley in and around Sarnia. A four-party accord was signed between Canada, the U.S., New York State and the Province of Ontario to clean up the Niagara River. Special attention was paid to the river because of the "Hooker Chemical" (now owned by Occidental) toxic waste dumps and other toxic waste discharges to the river. The Accord set a goal of 50 percent reduction by 1994.

Canada and the United States signed the Great Lakes Water Quality Agreement in 1978 calling for a goal of "zero discharge". Under the Agreement, a Great Lakes Water Quality Board was established. It identified 11 "critical pollutants" that are known to be highly toxic, persistent and bioaccumulate to levels that can threaten human health and the aquatic system.

The Board also identified 42 "Areas of Concern" in specific locations around the Great Lakes, requiring primary focus of attention. Remedial Action Plans (RAPs) are being developed for them, involving federal, state, provincial and municipal governments, as well as the public. The RAPs will include strategies for cleaning up existing polluted sediments and bays and for addressing major sources of discharge.

Ontario's MISA (Municipal-Industrial Strategy for Abatement) program, launched in 1987, is designed to virtually eliminate the discharge of persistent toxics into the Great Lakes and other provincial waterways. The new government in Ontario has expressed its intention to speed up the process of achieving "zero discharge" by the year 2000.

In Quebec, the federal government has offered funds to help that province undertake an ambitious program for drastically reducing discharges into the St. Lawrence River. Among the key issues there is the survival of the river's Beluga whales. The whales have become so polluted that their carcasses have to be disposed of in toxic landfill sites.

Also the Great Lakes Governors and Premiers are exploring measures to fund a new Pollution Prevention Centre for the Great Lakes. It will join other Great Lakes focussed groups such as Great Lakes United and the Great Lakes Institute in trying to clean up North America's largest freshwater lake system.

Chapter 3

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NATIONAL ISSUES

IMPROVED DECISION-MAKING

Environmentally-sound decision-making must ensure that the health of the ecosystem is maintained and, where necessary, restored, for the use of present and future generations. The need to consider environmental factors explicitly in the decisions governments, businesses and individuals make was one of the main recommendations of the Brundtland Report. The National Task Force on Environment and Economy made improved decision-making the key theme of its report. The federal government's Green Plan makes it one of its priorities as well, allocating a quarter of its budget to environmentally-sound decision-making.

All levels of government have recently taken initiatives in the areas of internal organization, planning processes, public consultation and project assessment to integrate environmental considerations more effectively in their decision-making. Manitoba likely has been more thorough than most in this regard but several other jurisdictions can also point to the establishment of Cabinet or senior-level committees to promote sustainable development. Comparable examples can be cited in the private sector, where codes of ethics, environmental audits, and the liability of senior decision-makers for environmental harm are becoming increasingly prevalent.

In the last few years, the focus of environmental policy has shifted from a preoccupation over remedying the effects of environmental degradation — which often proves to be prohibitively expensive — to a concern for anticipating and preventing their causes. These causes are often bound to the decision-making processes behind them. The elements of improved decision-making include an ecosystem approach (this element is developed further in the section on Environmental Protection), accountability, environment/ economy integration, the application of new policy instruments and improved environmental information.

1. ACCOUNTABILITY

Accountability is emerging as one of the key environmental issues of the 1990s. Many of the institutional reforms which are the subject of public debate have increased accountability as a common theme: this is true of environmental assessment, the enactment of environmental bills of rights, the creation of more opportunities for public input in decision-making, the establishment of an environmental auditor and the development of environmental indicators.

Low confidence in government and large corporations is at the root of the rising public concern over accountability. As the public becomes increasingly concerned about the economic and health costs of environmental degradation, it will demand a more thorough accounting by both government and the private sector of the actions they take to protect and restore environmental quality.

Governmental accountability over environmental issues is muddled by a division in federal-provincial responsibilities which does not correspond to ecological principles. The Canadian public has been confused by the resulting jurisdictional overlap. The essence of ecosystem management — reconciling the fundamental incongruity between political and ecological boundaries and transcending the parochial tendencies of individual jurisdictions in favour of advancing the common good — represents a formidable institutional challenge.

This overview of environmental accountability covers the following issues: environmental assessment, the creation of an environmental auditor, public consultation, environmental bills of rights, and aboriginal aspirations.

ENVIRONMENTAL ASSESSMENT

Environmental assessment has become a lightning rod for all stakeholders in environmental policy. Environmental groups lobby for a rigorous application of the process; industry worries about uncertainty and the potential for costly delay; provincial governments try to protect their jurisdiction from perceived federal encroachment; the federal government is concerned about losing control over its process to the courts. It will continue to be a very high profile issue, in part because its application remains one of the most visible manifestations of the extent of governments' commitment to the environment. Furthermore, the application of the process provides an endless series of platforms for confrontation.

The objective of environmental assessment is to promote the integration of environmental considerations as a primary part of all social and economic decision-making for the short- and long-term benefit of society through an open, participatory and consistent process.

- Canadian Environmental Advisory Council, 1988

Every province now has a legislated environmental assessment process. Ontario, Saskatchewan and Alberta are reviewing their process while the Yukon is formulating a Development Assessment Process. At the federal level, Parliament is reviewing a bill (C-78) to reform the current environmental assessment and review process. In early 1991, the fate of this bill is uncertain: several of its provisions have been severely criticized by environmental groups; the provincial environment ministers (except Quebec's) have proposed amendments to the bill designed to reduce overlap between the federal and provincial processes. In addition, several court cases are pending regarding the existing federal review process (related to dam construction in three provinces and pulp and paper mill development). Their outcome may well influence the ultimate design of federal environmental assessment.

Although most political and media attention is likely to focus on seemingly isolated causes célèbres (such as Rafferty-Alameda, Oldman, James Bay II so far; in the next few years, pulp and paper mills, waste disposal), these are in fact the outward manifestation of more fundamental issues which cut across all these projects. These issues include:

- the scope of process. Issues related to scope are particularly difficult and involve the range of permissible exclusions; the definition of the word "environment": is it biophysical only or should it also include socio-economic considerations?; and the application of the process: should it just involve physical projects or government initiatives and proposals too?. The federal government's commitment to assessing major cabinet policies for their environmental effects may put pressure on the provincial governments to follow suit.

- auditing and monitoring process. How adequate are the checks and balances in self-assessment? Is an independent overseer, such as an environmental auditor needed?
- public review. *Issues include intervenor funding*, independence of panel, hearing procedures (cross-examination, subpoena of witnesses). To what extent are alternative forms of conflict resolution, such as mediation, possible?
- interjurisdictional cooperation. How is overlap reduced and areas of jurisdiction protected while meeting public demands for effective assessment?

ENVIRONMENTAL AUDITOR

The idea that an independent environmental auditor should be established to oversee the implementation of the federal government's environmental decision-making process has gained considerable currency in the last two years. Such a position would reassure the public that the on-going self-monitoring and review process which characterizes the administration of environmental assessment in Canada is not being abused. The establishment of an environmental auditor has been advocated by, among others:

- a coalition of 28 environmental and aboriginal organizations in A Greenprint for Canada;
- the National Round Table on Environment and Economy;
- the House of Commons Standing Committee on Environment.

As an alternative, it has been suggested that existing auditors general could assume these responsibilities. The Auditor General of Canada may indeed already be positioning himself to start filling this role. In his 1990 annual report, Mr. Dye notes that environmental protection is "a prime example of the need for accountability" and lists six areas of reporting which his office will monitor in coming years.

PUBLIC CONSULTATION

Fuelled by mistrust, public expectations about the appropriate forms of consultation are rising faster than governments' ability to deliver. This is true even though governments engage in more consultation than ever before. To confuse the issue further, the public often sends conflicting signals: it wants both forceful government leadership on the environment (often implying immediate action) and to be consulted in advance on such actions. The public is increasingly rejecting the model of "executive federalism". This issue transcends the environmental policy field and is a symptom of a much deeper discomfort with the way in which our democratic institutions have evolved (viz., the almost universal condemnation of the constitutional process). It is important to point out that, whereas environmental stakeholders will mostly disagree on substantive issues, their differences are largely bridged on process issues such as consultation and access to information.

As a result of rising expectations, governments face a ratcheting effect: the previous "good" consultation process becomes the minimum standard for the next one. Several successful multistakeholder consultations (e.g., Niagara Process, Energy Options) are widely touted as models for future consultation processes. But it is important to note that consultation may increase conflict and lead to public frustration where issues are polarized (e.g., nuclear power) or where the government is unprepared to meet public expectations. In the Green Plan, the federal government committed itself to reviewing the public consultation process on environmental issues. CCME is also reviewing its public consultation practice.

The public is becoming more sophisticated and is better able to participate than ever before. This is true both for the general public which is spawning a large number of environmental organizations to represent it in various causes and for industry which as a result of its growing interest in the issue is learning how to participate more effectively in public debates.

The consultation "load" will increase rapidly in the next few years. The federal government is already committed to a series of consultations as a result of CEPA and the Green Plan. The Round Tables will hold their own (Manitoba, New Brunswick and Ontario are already in various stages of public consultation on sustainable development strategies). This trend raises a series of questions: how will the government derive maximum value from these consultations? how can the public and stakeholders make the most effective contribution? how should consultation processes be "matched" to the kind of advice sought? how can overload, consultation "fatigue" and cynicism be prevented?

In a related vein, it is likely over the next few years that governments will no longer unilaterally set the consultation agenda. The private sector is increasingly conducting its own consultations (viz., the Canadian Petroleum Association's well-received guidelines for public consultation). As formal and informal channels of communication between environmental groups and business grow, government's latitude in deciding how and on what to consult may diminish.

ENVIRONMENTAL BILLS OF RIGHTS

An alternative to direct government regulation of polluters is the "environmental bill of rights". These bills come in the form of legislation enabling the individual, rather than the state, to enforce environmental laws. The operative provision of this legislation is its lowering of the traditional barrier to such enforcement — standing, which resides exclusively with the state under its parens patriae jurisdiction unless the individual can prove special and distinct damages. Such a bill of rights does not go as far as to allow individuals to sue for general common and civil law remedies like nuisance. It does, however, provide an additional mechanism by which statutory remedies can be enforced.

Although there is no indication that the 1990s will see a lessening of government enforcement of environmental harm, one can also expect to see an increase in the number of private suits.

Other important components of such legislation are the provision of compensatory damages for general harm to the environment; protection from discrimination for public servants who disclose environmental violations of their employers; public access to government information; and the office of an environmental auditor or ombudsman with a broad mandate to investigate and advise on the performance of agencies, management strategies and legislation and to provide access to information.

One such bill of rights was enacted in New Jersey as early as 1974. The operative provision of the Act reads,

> *Any person may maintain an action in a court of competent jurisdiction against any other person to enforce or to restrain the violation of any statute, regulation or ordinance which is designed to prevent or minimize pollution, impairment or destruction of the environment.*

The Northwest Territories has recently adopted an Environmental Rights Act (1990) which similarly grants "every person the right to protect the environment ... from the release of contaminants by commencing an action in the Supreme Court". The bill defines "contaminant" very broadly to include "any solid, liquid, gas, heat, sound or vibration" which impairs the quality of the environment or adversely effects human health or comfort. It expressly provides for access to information as a corollary to public interest in and prosecution of environmental offenses.

Quebec does not have a distinct environmental bill of rights, but the Environment Quality Act, articles 19.1 and 19.2, grants standing to individuals to sue for violations of that Act causing injury to the plaintiff. The Act does not grant standing to individuals to sue for clean-up or remedial work, nor does it grant standing to sue for violations of any other environmental legislation.

For its part, the Ontario government has announced its intention to table an environmental bill of rights in the provincial legislature in the spring of 1991 following consultations with stakeholders. This bill is to be based on the following principles:

- the public's right to a healthy environment;
- the enforcement of this right through improved access to the courts and/or tribunals including the right to sue polluters;
- increased public participation in environmental decision-making;
- increased government responsibility and accountability for the environment;
- greater protection for employees who "blow the whistle" on polluting employers.

The aboriginal claim to self-government over natural resources is two-fold. On the one hand, aboriginal groups seek a share of the revenue from mining, forestry and oil drilling on lands that the native peoples regard as their own. On the other, they have their own views and values regarding environmental protection, which may conflict with those held by other Canadians. In considering native involvement in environmental management, a distinction should be made between management powers native people have over their own lands and the powers they have or claim beyond their boundaries. This is important because traditional native lands and the lands which many native people still harvest are often more extensive than the lands which they actually own. It is also important because development on land adjacent to native lands can raise major problems for native people.

Models for involving native people in environmental management exist. Two Indian groups have negotiated non-constitutional self-government powers, including environmental management powers, outside of the context of the Indian Act. Indians in northern Quebec fall under the Cree-Naskapi Act. The Act empowers the Indian band to legislate on access and residence for native lands; zoning and land use planning; expropriation of lands for community purposes; regulation of buildings, parks and recreation; protection of the environment including natural resources; regulation of hunting, trapping and fishing, and regulation of transportation.

In British Columbia, the Sechelt Indian Band falls under the Sechelt Indian Band Self-Government Act. The Band Council may make laws respecting the preservation and management of natural resources and fur-bearing animals, fish and game on Sechelt lands. In addition, by federal and provincial agreement the Band may be granted management powers outside reserve lands via the creation of a "Sechelt Indian Government District".

Claims settlements have resulted in a variety of joint Canadian-native arrangements which project native management powers beyond native lands. For example, Section 22 of the James Bay and Northern Quebec Agreement establishes a body, appointed by the Cree, Canada and Quebec, which has environmental management powers for extensive parts of northern Quebec. The Inuvialuit Final Agreement establishes a joint council to advise government on matters relating to wildlife habitat and harvesting in the Western Arctic. The agreements-in-principle reached with the Council for Yukon Indians and the Inuit of the Central and Eastern Arctic are more far-reaching still in establishing joint decision-making boards over many aspects of renewable resource management. These agreements, which explicitly endorse the concept of sustainable development, can be expected to influence aboriginal demands in other regions of Canada where comprehensive claims are still outstanding.

It will be noted that the models referred to apply mostly to native people living on, or beyond, the development frontier. Those living in densely populated, industrialized areas, such as the Mohawk near Montreal, the Walpole Island Band of Lake St. Clair, and the Musqueam of greater Vancouver present different problems and would probably require different management arrangements.

In September, 1990, Prime Minister Mulroney announced a new "Indian agenda" which is to have four aspects: land claims, the economic and social conditions on reserves, the relations between aboriginal peoples and governments, and concerns of aboriginal peoples in contemporary Canadian life. On land claims, there would be three parallel initiatives: the acceleration of the settlement of specific claims, the honouring of legal undertakings regarding land transfers to treaty Indians, and the acceleration of negotiations on comprehensive claims. The government will no longer limit itself to handling six claims at any one time, and will consider other innovations such as regional and province-wide negotiations.

2. ENVIRONMENT /ECONOMY INTEGRATION

CHANGES IN GOVERNMENT DECISION-MAKING

The transition to sustainable development requires an "alternative" or "sustainable development" agenda. It should embrace all of the issues that have long been thought of as simply environmental, natural resource or urban issues, but integrate them with the dominant issues of growth, development, employment, and energy. It should shift attention to the entire development cycle, viewing environmental degradation from the perspective of its common sources in the policies, programs and budgets that drive development. It should lead to action on the sources of the issues in human activities; in the policies, attitudes and behaviour patterns underlying these activities; and in institutions and the forms and processes of decision-making. There is also growing agreement that it must lead to making the major spending agencies of government more responsible for anticipating and preventing the environmental consequences of their spending decisions.

This issue will never attain high public visibility but is of fundamental importance. The Brundtland Commission flagged it in recommending that "environmental protection and sustainable development must be an integral part of the mandates of all agencies of governments...". For its part, the National Task Force on Environment and Economy made several recommendations designed to change the way in which the government makes decisions:

- more research into market based incentives for sustainable development by universities, the private sector and government organizations such as the Economic Council and Statistics Canada
- cabinet documents and major government economic development documents should demonstrate that they are both economically and environmentally sound
- the establishment of formal mechanisms to hold all Ministers and their departments accountable for promoting environmentally sound development
- Environment Ministers to become members of key economic development and priorities and planning committees of cabinet

- CCREM to provide a forum for continued harmonization of environmental standards and legislation and the streamlining of environmental assessment across Canada
- the establishment of a number of procedures to ensure that all Ministers become directly responsible and accountable for the environmental and economic consequences of their policies, legislation and programs
- for industry to take up the challenge of sustainable development by supporting environmental assessment as an integral part of the decision-making process, adopting environmental principles and codes of conduct and the preparation of annual reviews of environmental performance for their boards of directors
- provincial and territorial governments to have conservation strategies in place by 1992 and for a national strategy to be ready for ECO '92
- for each territory and province to establish a Round Table on the Environment and the Economy.

While all governments across Canada have taken steps to implement these recommendations, progress across the country in achieving these standards is uneven.

ROUND TABLES ON ENVIRONMENT AND ECONOMY

The provinces, territories and the federal government have all established Round Tables on Environment and Economy in response to the National Task Force recommendation. On the whole, the Round Tables have remained true to their original mandates and the recommendations for their composition. They all have a number of senior private sector representatives. They all have a number of representatives from the environmental community. All, save B.C., have a number of government representatives, and the B.C. group contains senior public servants.

Some have embarked upon elaborate consultative exercises. New Brunswick organized a series of public discussions leading to the preparation of its sustainable development strategy. British Columbia held in excess of 22 Round Table meetings and workshops in 1990 alone. The Manitoba Round Table has now produced a draft sustainable development strategy which will be the subject of a major public consultation exercise in 1991. Ontario has produced a Challenge Paper to set the agenda for its sustainable development strategy and has also established a number of sectoral task forces which will hold public consultations to prepare inputs for the strategy.

The social experiment which the Round Tables represent is still inconclusive. None has yet gone through the hard choices necessary to integrate environment and economics in the form of a sustainable development strategy. None has yet presented a report to its government that requires immediate action. The federal government has announced no plans for a national strategy and the National Round Table also has not expressed an intention of producing one although it will initiate a series of "dialogues" among stakeholders in various economic sectors. The value of this experiment, however, will become clear very soon. Over the next two years, most provincial governments will have to react to the conservation or sustainable development strategies which the Round Tables are preparing.

3. POLICY INSTRUMENTS

Environmental policy in North America has been dominated by the traditional "command and control" approach to regulation. At one extreme, this approach not only can mandate and set standards, but also the technology which must be used to achieve these standards. This approach is characterized by phrases such as "best available technology" or "best practicable technology". At the other extreme, this approach may be used in combination with other instruments. But typically, it still sets fairly inflexible standards without reference to the firm's ability to adjust or develop new technologies. The command and control approach has very real political advantages, especially in an age of public concern with the environment. It appears simple, it treats everyone the same way (unless an excessive amount of "grandfathering" is involved), and it is often combined with pledges to punish polluters severely. It may also be popular with some segments of industry who see it as predictable.

Recently, this approach has come under criticism. Part of this critique comes from the Brundtland Commission and the National Task Force. They point out that command and control is almost exclusively designed to cure environmental problems once they occur and is not an optimal tool for pollution prevention. Other critics point out that it stifles the development of new and imaginative technologies, especially where regulations actually specify engineering details.

This has all led to a spate of new writings and some experimentation, especially in Western Europe, with several new techniques for measuring ecological capital, pollution taxes, emissions permits and the privatization of common property resources. The Organization for Economic Cooperation and Development (OECD) has actively been developing new approaches to economics and the environment for a number of years. The new program goes beyond the organization's traditional concern for economic instruments and resource pricing to look at the adaptations of fiscal systems for environmental purposes. A number of countries have begun to experiment with some of these new economic methods for dealing with the environment.

In the spring of 1988, the Swedish government presented a bill on environmental policy for the entire government to its legislature. The Swedish program is extensive, cutting across all government departments and stressing, as a matter of policy, the prevention of problems rather than the curing of symptoms. It lays down a series of hard targets for each sector of the Swedish economy, including taxes on heavy trucks, investments in high speed trains and a carbon tax on fossil fuels. Norway has also imposed a tax on cars entering Oslo city centre and has substantially raised its gasoline taxes. Since July a tax has been levied on the production and use of CFCs with a goal of complete elimination by the year 1995. Norway has committed itself to energy conservation and taxing policies which will result in the stabilization of CO2 emissions by the end of the century. Energy and transport policies will be adjusted to bring about major reductions of NOx (30 percent by 1988) and SO2 (50 percent by 1993). Denmark passed a CFC tax and a charge on pesticides and very high taxes are now levied on garbage recycling. Legislation now before parliament will triple the rubbish charge and will increase taxes on the uses of raw materials.

This new approach appears to have found favour with Canada's federal government. The Green Plan contains a provision for the release of a discussion paper in 1991 on the use of economic instruments in environmental protection. The Plan also calls for the establishment of a network of research institutions on the use of economic instruments and the establishment of emissions trading arrangements with the provinces.

MEASURING ECOLOGICAL CAPITAL

The merging of environment and economics requires that we treat the world's renewable natural resources as capital and that we attempt to live off the interest of that capital, rather than constantly running down the principal as the statistics tell us we now do. This will require accounting for the ecological capital in a country's balance sheet, much as we now account for the manmade capital of housing, factories, roads, machinery and the like. At the moment, a country's GNP is increased each time it cuts down a tree to manufacture a product. All of the labour and machinery that go into the production of plywood or pulp or furniture are quite properly counted as an addition to the country's well-being. The mills that are constructed to carry out these activities are counted as being an addition to a country's economic prosperity. But nowhere in the national balance sheet do we account for the value of the diminishing forest resources. As the World Bank economist Herman Daly put it, this is a bit like running the world as if it were a company in liquidation, especially if up to three-quarters of the value of a country's exports are derived from its renewable natural resource base — a common phenomenon in many developing countries. To see what kind of difference this sort of accounting might make, a group of American economists tried to construct a set of national accounts for Indonesia that took into account the change in the value of the country's forest resources as they were exploited and not sufficiently restocked. They found that the growth rate of Indonesian GNP during the period studied dropped from an average of seven percent per annum to about three percent per annum.

The Green Plan is quite encouraging on the subject of revising the national income accounts to show the value of ecological capital. Canada will be hosting an international conference on the subject next year and the Plan commits the government to implementing pilot accounts for natural resources over the next 18 months, with regular publication of the environmental components of the new accounts by the year 1996.

The Ontario Round Table Challenge Paper suggests that the province begin to apply these principles to the value of its own natural resources as part of the development of a sustainable development strategy. Other CCME members might want to consider initiating research in this area or entering into partnerships with the federal government.

MARKET BASED INCENTIVES (MBIS)

Perhaps at the other end of the spectrum from the command and control approach are the "market-based incentives" (MBIs), now being greeted with new enthusiasm. Popularized by the British economist David Pearce, these are attempts to intervene in the market to create the conditions for environmental improvement. They take several forms, and can intervene in a production process at different stages.

Though command and control may continue as an approach to regulation, arguments have been advanced that a more efficient allocation of both government and social resources would result from a greater use of MBIs. However, the replacement of a large part of the current regulatory system with MBIs would require a significant change in attitude on the part of regulators. Pollution and its regulation would have to be treated primarily as economic matters, though the regulatory system would still need to be medically and scientifically based. Various types of pollution would be treated as costs imposed on society in the form of depreciating natural capital, morbidity and mortality, aesthetic damage, and so on. As Pearce has put it, regulation would then be about driving a "wedge" between economic activity and its impact on the environment.

The use of market based incentives would lead to less expensive regulation by allowing government to shift regulatory costs to the private sector via the price mechanism. Since government would continue to determine regulatory content and standards, the principal advantage to government would be a reduction of monitoring and compliance costs. As well, government could gain financially with a reduction of perverse subsidies and the application of corrective taxes.

Because they employ market mechanisms, incentives should also be superior to command and control in making product prices reflect true production costs. Economists distinguish between the internal costs of a firm — the cost we encounter on the profit and loss statement — and "externalities" which lie outside of the firm's cost structure. Externalities are very much a part of the costs of production — the part that a firm or industry does not have to pay for but which fall on society. Industrial pollution, in whatever form it has taken, has historically been treated as an externality. "Internalities" and externalities, together referred to as the "social costs" of production, should jointly determine product price (though, where monopoly elements exist, prices will still be distorted away from socially optimum norms).

However, externalities will not enter into price unless forced to do so (or to use Pearce's term, unless "wedged-in") by regulation. This is important because externalities are often major costs. When regulators force them into private cost structures by, for example, removing a perverse subsidy (e.g. support of chemically based farming) or by imposing a green tax (e.g. on carbon fuels), producer and consumer choice is placed on a more socially optimum footing (assuming, of course, that a clean environment is socially valued). Both producer and consumer must now decide if they want a product at the higher cost and price, or if they want as much of it as they had before. If the increase in the cost and price of a valued product is sufficiently large, it should encourage a search for new products and less costly methods of production.

It must be remembered that market based incentives will not entirely eliminate reliance on command and control. Many environmental actions governments must take are of a non-market character - the development of parks or the protection of endangered species, for example. As well, monopolized markets may be insensitive to price-based approaches, except in the long-run (e.g. tobacco, alcohol).

It must also be noted that an incentive based approach would not reduce governments' regulatory responsibility. As with command and control, governments would continue to set regulatory agendas, establish standards, and ensure compliance. Nor would the use of market based incentives diminish the need for government support of research into pollution causes and effects.

The incentives can take several courses.

Taxes and Charges

Taxes or charges can be applied to inputs, effluents or to the final product. The most controversial of the first is the much discussed carbon tax. The purpose of a carbon tax is to raise the price of the most CO2 producing fuels high enough either to induce fuel switching or to persuade users to use the fuel much more efficiently. Sweden now has a tax of this type and other countries are considering following suit. Although Mr. de Cotret was under intense pressure from the environmental lobby to introduce such a tax in Canada, it is not present in the Green Plan and is unlikely to be introduced in the near future. There appear to be two major problems with this sort of input tax. First, it treats all users of the input in the same way — those who have introduced fuel efficient technology must pay the same penalty as those who have not. Secondly, the government maintains that a carbon tax in Canada which would significantly reduce consumption would have to be very high — indeed, too high to be politically acceptable.

Taxes or charges can also be introduced on effluents or emissions. Perhaps the best known are the European water effluent charges. First introduced in the Ruhr in the early part of the century, they have been most successful in the Netherlands, where successive governments have kept the charges high enough to persuade both industry and households to reduce the amount of wastewater needing treatment. British Columbia has a fee schedule for ambient, liquid and solid waste for a wide variety of commercial and industrial establishments from dairy farms and dry cleaners to mining and oil refineries. Although the scope of the regulation is appropriately broad, the fees imposed are arguably too low to encourage serious investment in waste reduction. They are also on a linear scale rather than a geometric one, providing little disincentive to pollute more.

Finally, the most common of user charges are the taxes on final products. Ontario and British Columbia both levy tire taxes, designed to help pay for the disposal, recycling or re-use of the discarded product.

Emissions Permits

A more complex market scheme is the "emission trading certificate" recently enacted as the cornerstone of the 1990 amendment to the U.S. Clean Air Act. The Clean Air Act, administered by the Environmental Protection Agency

(EPA) is the primary vehicle for combating air pollution. Two of the Act's major components, part of a 1970 amendment, require the EPA to establish national ambient air quality standards (NAAQS) for common pollutants and to establish national emission standards for hazardous air pollutants. NAAQS target "criteria pollutants" such as sulphur dioxide, nitrogen oxides, particulate matter, carbon monoxide and chemicals that contribute to the formation of ozone. The EPA sets standards, reviewed every five years, for maximum emission concentrations of these substances, according to public health concerns. Each state must then develop a State Implementation Plan (SIP) whereby the standards are enforced on a source-by-source basis. New sources are not eligible for the same standards as existing sources but rather are subject to increasingly strict controls for criteria pollutants according to the "best available demonstrated control technology". Both existing and new sources which fail to meet their NAAQS are then subject to the more stringent measures of the non-attainment program requiring the source to install the best pollution control technology, "reasonably available" to that particular source category. Section 112 requires that hazardous pollutants be subject to a more stringent regulatory strategy. "Hazardous substance" is defined in the Act as that contributing to increase in mortality, serious irreversible illness, or incapacitating illness.

The Clean Air Act amendment of 1990 seeks to improve the enforcement mechanisms of the Act, by further increasing administrative powers, lowering permissible emissions and creating a market scheme for tradeable emission allowances. First, the amendment sets a single national cap for total sulphur dioxide emissions. Improved monitoring and enforcement powers for the administering agency, the EPA, and increased criminal penalties for both the polluting business entity and its directors and officers insure that this national cap will be respected. Second, the distribution of emission allowances to existing utilities and the creation of a free market to trade in those allowances, leave latitude as to how that cap will be respected.

The market mechanism, Title IV of the Clean Air Act Amendments, concerns the control of acid rain precursors, sulphur dioxide and nitrogen oxides. The operative provision of Title IV is the establishment of an emissions allowance and trading program for sulphur dioxide (sources may be allowed to substitute nitrogen oxide at a rate of 1.5 units of nitrogen oxide to 1.0 of sulphur dioxide). The amendment sets a national goal for the maximum emission of sulphur dioxide, with every concerned utility authorized to emit a percentage of that total. The cap sets as a goal a ten million tonne reduction in total sulphur dioxide emissions by the year 2001. An emission certificate authorizes release of a fixed volume of fixed toxicity of a given pollutant. Each utility annually receives a specified number of these allowances. Certificates will also include monitoring and reporting requirements. Utilities must have allowances for all emissions, on pain of heavy fines. They are free, however, to sell, save or purchase allowances according to their needs. It is in the market for these allowances that the value of the right to pollute is determined. Interested parties bid to purchase emissions certificates in a decentralized marketplace rather than in the centralized planning process of state and federal governments. Trade in the market for pollution allowances is expected to reduce the costs of abatement. A central government agency, the EPA in this case, should keep records of all transfers to facilitate the monitoring of actual vis-à-vis permissible emissions. New plants or new units of existing plants must obtain emission certificates, either by sale or by transfer from another unit within the same entity.

This trading provision, when combined with a national cap on total emissions and rigorous monitoring, assures that the government's goal is achieved while leaving industry the option of how to achieve it. By requiring individual utilities to bear the cost of reducing emissions, the scheme nevertheless requires the polluter to pay. What is likely to result is a weighing of the cost of installation of pollution control equipment against the purchase price of an additional emission allowance. Manitoba has provided for a similar strategy whereby the Governor in Council can create a market for the emission of specific pollutants. The revenue generated from the sale of emission certificates is then to be held in trust for an environmental contingency fund for use in the event of an environmental emergency.

Industry has voiced concern that the envisioned market will fail to develop, creating a hoarding network wherein more powerful companies will succeed in wresting control of a majority of the emissions certificates. Proponents of the amendments counter that hoarding or the refusal to sell to a needy buyer will not occur due to anti-trust legislation and the equalizing force of a free market place. Because emissions trading on an industry-wide scale has never been attempted, it remains to be seen whether these concerns are warranted.

The Green Plan contains several references to tradeable emission permits, including a commitment to cooperate with the provinces to incorporate trading into federal/ provincial agreements by 1993 for the B.C. Lower Mainland and the Windsor/ Quebec and Saint John areas.

Tax Incentives and Subsidies

A third market mechanism is the tax incentive. Under the Income Tax Act, an accelerated capital cost allowance is provided for the purchase of pollution abatement equipment. The accelerated nature of this write-off promotes the use of the eligible technology. Tax rebates and investment tax credits are other means by which to encourage the growth of the market for pollution abatement equipment and processes.

Environmental taxes are in use in various countries. Items on which Denmark has placed environmental taxes include CFCs, beverage containers (refundable), solid waste, disposal of waste tablewares, pesticides in small containers, raw materials, and unleaded gasoline. France's Plan Vert envisages increased water charges; taxes on sulphur oxides, nitrogen oxides, hydrocarbons and solvents; charges on waste disposal sites (with revenues earmarked for waste reduction measures). Many governments have supplemented favourable tax treatment provisions for pollution control equipment with subsidies provided directly to producers.

Subsidization can play a positive role. For example, Norway subsidizes environmentally friendly electricity production and uses a combination of subsidies and taxes to steer consumers towards automobiles which produce the fewest exhaust gases. Canada has subsidized small domestic hydro power projects and home insulation programs.

More important than the provision of ecologically based subsidies is the removal or modification of those existing subsidies which are often the source of degradation and depletion of a country's stock of ecological capital. The subsidization of inefficient, at times archaic, production processes has been a significant factor in pollution. Two recent examples come to mind with great clarity. One is the bias in the fiscal structure of prairie agriculture which not only drives farmers to produce large quantities of crops for which there is no market but also encourages them to drain wetlands and cultivate marginal land. The other is the structure of subsidies and tax incentives which led to the overcapitalization and subsequently the near collapse of the North Atlantic cod fishery.

Privatizing Common Property Rights

Perhaps the most controversial set of suggestions for market based instruments involves the privatization of certain common property rights. The argument for such a system is quite simple. If a common resource, such as forests or water, is not closely regulated, it tends to be treated by the market as a "free good" into which wastes of all sorts can be deposited. And, in Canada at least, the regulatory process has not been a great success.

The exponents of private property rights point to the far superior record of forest management on private lands, to the regulation of water quality in many streams and rivers in Europe by fishing clubs and the like. A number of Canadian researchers have argued that the only long term solution to Canadian forest management problems lies in transferring long term development rights to the private sector.

4. ENVIRONMENTAL REPORTING

In their role as managers and protectors of the environment, governments generate the bulk of environmental information in Canada. In 1985, the federal government alone spent $550-million and allocated 6,470 person-years to its environment and natural resource surveys. [10]

This information is not widely accessible. Many government departments collect environmental information for their own policy-making or regulatory uses but have no reason to ensure that the information they gather is consistently reported. The 1987 report of the stakeholder group on environmental reporting noted the following barriers to environmental information in Canada:

- no comprehensive network of information sources;
- no comprehensive framework describing the scope or extent of interactions between human actions and the environment;
- little knowledge of, and often no means of obtaining, data collected by industry, hospitals, universities and research institutions for their own specific purposes;
- insufficient data to permit understanding of linkages between economic

activity and resource activity or to permit effective risk analysis or epidemiological studies;

- no independent institution or agency capable of assembling environmental data and assisting in interpretation;
- inadequate ongoing national monitoring program to determine levels of toxic substances in human, fish and wildlife populations;
- significant regional variations in the availability of data. [11]

Although some of these barriers are being overcome, they continue to impede state of the environment reporting. Canada's performance in this regard generally reflects an international neglect of environmental information.

These problems do not exist only on the federal level. In Quebec, for example, La Commission d'enquête sur les déchets dangereux concluded that it was impossible to calculate the volume of hazardous wastes in the province, in part because the provincial environment ministry, which is responsible for managing these wastes, has no jurisdiction over the wastes produced by mines, the aluminum industry, pulp and paper plants, hospitals or the agricultural sector — all of which are regulated by different provincial departments.

Other barriers to timely national environmental reporting include:

- many data are based on census information and are therefore updated only every five to ten years. Some data, however, are out of date because little apparent effort is made to collect them even in areas of ostensible priority. Thus, the latest comprehensive Canadian survey of hazardous wastes was done in 1982. Even acid rain information is two years old by the time it is published. The lack of up-to-date information makes it more difficult to assess the effectiveness of government environmental programs.
- some data are no longer being collected: for example, the federal government has stopped collecting data on changes in land use as a result of budgetary reallocations in Environment Canada. There are no plans to collect more information on the impact of urbanization on agricultural land.
- some data are not directly comparable: for example, different standards of air quality are being used in individual provinces. The same applies to definitions of "NSR lands" (not sufficiently restocked lands) in forestry. The criteria for the protection of natural areas and mapping of natural regions also differ from province to province.
- many data are incomplete. For example, the data on endangered species do not include invertebrates and have incomplete coverage of plants and fish. On the other hand, sub-species or independent populations (e.g., the St. Lawrence beluga) are listed although the species as a whole is healthy.

Canada's first State of the Environment (SOE) report was published in 1986. The second report, to be published in 1991, uses a different approach in reporting environmental information and its results will not be directly comparable to those in the first report.

Quebec has published one State of the Environment report and is planning a second one in 1992. Manitoba, Saskatchewan and British Columbia are all to release SOE reports in 1991. Alberta, the Northwest Territories and Yukon are planning their own SOE reports but have not established publication dates. Since 1980, Environment Canada has published an SOE report for the Atlantic region every five years.

The federal government's Green Plan makes a number of commitments related to:

- natural resource accounting;
- a national environmental information network;
- a national state of the environment organization;
- environmental indicators.

As the link between human health and environmental quality becomes more firmly established, public demand for access to environmental information is likely to increase. The federal initiatives in the Green Plan may put pressure on the provincial and territorial governments to release more environmental information in their possession.

ENVIRONMENTAL INDICATORS

The public can judge a government's economic performance informally by relying on a wide array of economic indicators: every day, the value of the Canadian dollar and fluctuations in the stock market are widely reported; every week, the Bank of Canada's setting of interest rates is eagerly awaited; every month, Statistics Canada publishes figures on the balance of trade, unemployment, the rate of economic growth and inflation. These indicators play a powerful role in communicating to the electorate what is the state of the economy. They not only influence decisions taken by consumers and investors but also the government's political popularity.

There is no parallel system of environmental indicators in Canada today which would allow the electorate to judge the country's environmental performance. Environment Canada started to fill this gap by publishing a preliminary set of environmental indicators in 1991. One of the challenges governments face is to gain acceptance for scientifically-sound indicators before the public or interest groups develop less trustworthy ones.

Data for some of the most important environmental indicators do not exist, for example:

- *Agriculture* — tons of topsoil lost/ hectare or amount of wetlands lost; remaining organic matter in soils; total amounts of pesticides, herbicides and fertilizer applied or return per level of effort (do we have to use more and more fertilizer for the same crop?)

- *Fish* — Ontario is the only province to research in detail the presence of contaminants in fish and publish the results. The health of the fish at the top of the food chain is a good indicator of the health of the entire aquatic ecosystem.

- *Human health* — PCB (or dioxin-equivalent or other toxics) content in mothers' milk; number of people at risk from hazardous wastes.

ENVIRONMENTAL PROTECTION AND REHABILITATION

It is human activity which gives rise to the issues described in other sections of this report — activity which has altered the physical features of the earth and the quality and quantity of its resources. Not only have we seriously depleted many of these resources and contaminated the air, water and land: the changes people have wrought are so profound that degradation of the environment is now affecting the health of biota and humans.

The resolution of environmental issues requires approaching the problems they pose from different points of view. This section takes a different focus by concentrating on the human activities which give rise to present day environmental issues, and argues that these activities must be considered in the context of the "ecosystems" in which they take place.

1. THE ECOSYSTEM APPROACH

Environmental protection means managing human activities so that their effects on the environment are eliminated or minimized. There are two prime considerations: the activities themselves, and the nature of their interaction with the environment.

The activities which affect the environment are complex. The building of a roadway impinges on the environment in hundreds of ways, as does the introduction of a new chemical into common use. Consequently, environmental protection must be comprehensive and embrace the full scope of human activity.

First, this means anticipating and preventing further damage to the environment from new works, initiatives and products, and then scrutinizing their effects throughout all phases of their lifecycle. For physical projects, this involves assessing the environmental impacts of an initiative before it is implemented, and then mitigating and monitoring any impacts which do occur, up until and following project completion and decommissioning. For chemical products, it involves assessing the fate and effects of chemicals in an ecosystem, and assuring safe use and disposal are possible before one is introduced into the marketplace.

Second, environmental protection means controlling the effects on the environment of industrial practices and processes, other human activities, and commercial products which are currently damaging the environment, through all available means including regulation, financial assistance for implementing control measures, and developing new process and control technologies.

Third, it means restoring environmental quality where it has already been degraded, and dealing swiftly and completely with any accidental release of a polluting substance.

At the same time, we must realize that the environment itself is a complex system of natural processes, and that the activities of people affect the environment in diverse and intricate ways, many of which are still poorly understood. Confronting today's environmental issues through environmental protection and rehabilitation requires the acceptance of a fundamental point — everything is connected to everything else! This truism captures the essence of the complex interdependence of air, water and land systems and their related living organisms, including humans. With this "ecosystem approach", it is clear that in almost all circumstances it is human activity, not the environment, that needs to be "managed". It requires that we go beyond the piecemeal, knowing that decisions in one area can affect all others. Though this concept is accepted widely, it is neither understood well nor systematically applied.

The ecosystem approach has been pioneered in the Great Lakes basin, a region of Canada and the United States that is home to 37 million people and under the jurisdiction of two federal governments, eight states, two provinces, plus a multitude of counties, townships, municipalities and Indian reserves. The principal legislative instruments behind the ecosystem approach in the basin are the Boundary Waters Treaty of 1909 and, in particular, the 1978 and 1987 revisions to the Great Lakes Water Quality Agreement (GLWQA). This Agreement and its attendant institutions encourages the protection of the region based on boundaries of nature, not merely traditional political or disciplinary boundaries. It recognizes the inter-relatedness of physical, chemical and biological processes and the need to harmonize the human element with all other elements of the natural system. It acknowledges what has become obvious — that we live in a web of mutually dependent ecological relationships that range in scale from households and neighbourhoods, to nations and the global biosphere. The air, land and water issues facing us today make it clear that no single jurisdiction can act on its own in solving them.

The key characteristics of the ecosystem approach are described in Watershed, the interim report of the federal/ provincial Royal Commission on the Future of the Toronto Waterfront (Crombie Commission). The ecosystem approach:

- includes the whole system, not just parts of it;
- focuses on inter-relationships among the elements;
- understands that humans are part of nature, not separate from it;
- recognizes the dynamic nature of the ecosystem — a moving picture rather than a still photograph;
- incorporates the concepts of carrying capacity, resilience, and sustainability — suggesting that there are limits to human activity;
- uses a broad definition of the environment — natural, physical, economic, social, and cultural;
- encompasses both urban and rural activities;
- is based on natural geographic units — such as watersheds — rather than on political boundaries;
- embraces all levels of activity — local, regional, national, and international;
- emphasizes the importance of living species other than humans and of generations other than our own;

- is based on an ethic in which progress is measured by the quality, well-being, integrity, and dignity it accords natural, social, and economic systems.[12]

The ecosystem-dominated approach re-orients everything from local and regional decision making to the nature of future social and natural science research. It requires a more comprehensive and cooperative approach by all jurisdictions and professions. It is proactive, seeking to anticipate and prevent environmental degradation. It reinforces the notion of public trust, with governments as trustees for present and future generations.

The ecosystem approach is embraced in the goals for sustainability set in the World Conservation Strategy and the Brundtland Commission. Indeed, it is only the ecosystem approach that leads to sustainable development. Through the GLWQA and, more recently, the Crombie Commission, Canada has become a world leader in the development and application of the ecosystem approach. Through the CCME, it could be applied coast to coast.

An important aspect of basing decisions on an ecosystems approach is the assessment of the risk inherent in various government policies. A risk-averse environmental strategy will favour an anticipatory over a reactive approach to policy-making.

Risk assessment has been defined for the CCME as "the systematic, scientific determination of the likelihood that a hazard will cause adverse consequences, either direct or indirect, to human or non-human biota by physical, chemical or biological perturbation of the environment."[13] Although the identification and estimation of risk requires the application of scientific techniques, the assessment of risk is inherently a value-laden exercise. The determinations of what level of risk is acceptable and who should bear it cannot legitimately be made without some measure of public consultation on the trade-offs involved.

"There are no borders to pollution and there should be no borders between the people who are working to clean it up."

- Phil Weller, Freshwater Seas

It is against this background that the major environmental protection challenges facing Canadians are described below. The first section deals with the imperative of understanding and managing the effects of the chemicals and toxic substances we use every day and which find their way into the environment. This is followed by appraisals of specific environmental issues related to the three principal components of the environment upon which all life depends: the air, the water, and the land. Many of these latter issues have at their heart causes relating to toxic substances.

THE ECOSYSTEM APPROACH AND HUMAN HEALTH IN THE 1990S

There can be little doubt that the most alarming issues for the late eighties and early nineties are the effects of various kinds of environmental problems related to the exposure to persistent toxic substances, often in amounts that appear to be infinitesimally small. Since World War II, the numbers and amounts of toxic chemicals manufactured, used, discarded and discharged into the environment have increased dramatically. Between 100 to 200 new chemicals are being added to the Chemical Abstract Service every year. Several of these substances are known to pose serious threats to public health and the environment and the effects of many others have been inadequately studied.

Over the last decade or two, exposure to persistent toxic chemicals has been documented by measuring residue levels of organochlorines, such as PCBs, DDT and dioxins, in a variety of animal and human tissues, as well as by conducting individual and population exposure assessments. The effects of exposure have been assessed in many species, including humans. Particularly concerning are the effects of long term, low-level exposure from the long-range transport of airborne pollutants. No region, however remote, is assured of being safe.

In the Great Lakes basin, adverse effects from exposure to toxic chemicals have been demonstrated in sixteen top predator species. The babies of women who consumed as little as two meals of fish per month from Lake Michigan were shown to have a shorter average gestational age, a smaller average head circumference and a lower average birth weight than experimental controls. Some psychoneurological effects were observed at birth and others are now being observed as the children grow.

There is evidence that many persistent toxic chemicals have similar mechanisms of action in wildlife and human species, suggesting that effects on wildlife could be important indicators of effects on humans. Persistent toxic chemicals are known to bioaccumulate in food webs, so that concentrations are higher in humans than in biota at lower trophic levels. This is evident, for example, in problems related to PCB contamination of mother's milk among Inuit in the eastern Arctic.

The serious and widespread problem of persistent toxic substances in the Great Lakes biosystem requires an approach that enables the Parties, jurisdictions, municipalities and individuals in the Great Lakes basin to collectively lessen the current threat to the ecosystem. The premises for such an approach are:

i. All persistent toxic substances are ultimately harmful to the integrity of the environment, both in the Great Lakes region and globally, and should not be allowed to enter the environment.

ii. Persistent toxic substances find their way into the environment in many ways, through production, residuals, discharge, use and destruction.

iii. The technology either exists—or can with very few exceptions be developed at some cost—to replace (or control in the interim) the use of persistent toxic substances.

iv. Sufficient information is now known for society to take a very restrictive approach to allowing persistent toxic substances in the ecosystem and to declare such materials too risky to the biosphere and humans to permit their release in any quantity. The result in implications far beyond conventional measures of long-term net economic costs referred to in premise iii.

International Joint Commission Fifth Biennial Report on Great Lakes Water Quality, Part II, 1990

The first line of defence is to control these substances before they even reach the marketplace. The second is to control the release into the environment of those which are already being produced and used. And the third is to clean up toxic wastes and contaminated sites. The federal government's Green Plan calls for the "virtual elimination of persistent toxic substances" which extends the leading principle of the 1978 Great Lakes Water Quality Agreement. The Green Plan promises to further this goal by regulating the discharge of individual chemicals where toxicological evidence already exists, accelerating toxicology research, and promoting full lifecycle management of chemicals to reduce discharges beyond regulated amounts. The key instrument for doing this is the Canadian Environmental Protection Act of 1989.

However, crucial as they are, current approaches to the management of toxic substances do not address the fundamental need for a greater understanding of the fate and effects of these substances in ecosystems. The current thrust is limited and defined by what we don't know; that is, it aims to control only certain substances by limiting the amounts which may be introduced into the environment, without full understanding of what he true effects in ecosystems of all chemicals are, and without trying to find alternatives to their use.

Several observations in this vein can be made:

- It is almost impossible to establish the normal, scientifically accepted cause and effect relationships between exposures and specific effects. This is because humans are exposed to many chemicals over a lifetime, through several different exposure pathways (e.g., air, water, food) and because most chemicals do not cause unique effects. The traditional scientific method is inadequate. Simply doing more scientific research into causality in the environment, as most governments are now prone to do, will not provide sufficient assistance to decision makers. It certainly will not meet the growing need for answers among the public. A new scientific paradigm is needed to study interactions in complex ecosystems. This could be explored by applying general systems theory and developing integrative research methodologies to study relationships, interactions and functions in whole systems.
- To date, most research has focused on gross indicators of health in humans and wildlife (e.g., population status, mortality, cancer and tumours, birth defects). More subtle, but nevertheless important, indicators of health such as psychoneurological effects, effects on the immune system and developmental effects are only now beginning to be considered. In contrast, current definitions of health are extremely broad and emphasize the social and psychological aspects of health, as well as physical health.
- The medical profession has not taken a strong interest in the environmental determinants of human health, although recently there have been some notable exceptions, such as environmental hypersensitivity.
- The scientific disciplines involved are not communicating adequately with each other. In the case discussed above, human toxicologists and epidemiologists are not collaborating with wildlife toxicologists and epidemiologists and vice versa. Thus, studies on wildlife and humans are not being related to each other.
- Standards and guidelines related to toxic substances focus on individual chemicals; standards for environmental quality, based upon the ecological implications of such substances, are lacking. Such criteria are essential for making environmental protection policies and programs more effective.

> *"We know very little about the impacts of these [persistent toxic] compounds on ourselves as human beings ... [because] we've been afraid as governments to fund studies to look at those kinds of impacts."*
>
> - Dr. Wayland Swain, Testimony before the Alberta-Pacific Environmental Impact Assessment Review Board December 4, 1989

2. AIR ISSUES

URBAN AIR

Air quality in most Canadian cities with a population in excess of 100,000 is monitored by the federal government through the National Air Pollution Surveillance (NAPS) monitoring network. This network was set up in 1970 and standardized in 1974; thus, for most common air pollutants, at least ten years of data are available. Since 1974, the concentrations of several air pollutants have declined significantly, although ground level ozone and smog (of which ground level ozone is a main component) continue to be major urban air pollutants of concern.

Table 2

URBAN AIR QUALITY IN CANADA

POLLUTANT	1987 AVERAGE CONCENTRATION	% DECLINE 1978-87	% DECLINE 1974-87
sulphur dioxide	5 ppb	50	61
nitrogen dioxide	21 ppb	27	29
carbon monoxide	1 ppm	33	58
Ozone	16 ppb	no change	N/A
Total suspended particulate	48 ug/m^3	22	40
Particulate lead	0.1 ug/m^3	76	85
Coefficient of haze	0.28 COH	no change	26

SOURCE: National Urban Air Quality Trends — 1978 to 1987. Environmental Protection Series 7/UP/3, May 1990.

Ground level ozone is the most serious of measured air pollutants and is being produced in higher concentrations each year. In 1987, 52 percent of the stations recorded concentrations of ground level ozone exceeding the maximum acceptable level set by the National Ambient Air Quality Objectives.

Ozone is produced by the sun's photochemical actions on volatile organic compounds (VOCs) and nitrogen oxides (NOx), the major source in urban centres being the exhaust of cars, trucks and other gasoline-powered vehicles. These photochemical reactions are energized by temperature and sunlight in a stagnant air mass, and such conditions occur most frequently from late spring to early fall in most of the country's cities. A one-hour exposure to high levels of ozone, by itself or combined with other pollutants, can cause eye irritation, breathing difficulty and decreased visibility, and can damage vegetation. Apart from the deleterious local effects of smog on human health, it is also a greenhouse gas which contributes to global warming.

Since ground level ozone is not produced at a single point source, it is difficult to control. To reduce levels of ozone in Canadian cities, more stringent emission standards for vehicles will be needed, as well as a general reduction in the use of gasoline powered vehicles. CCME has committed itself to reducing ground level ozone to environmentally acceptable levels by 2005.

The federal government's Green Plan has set the goal of nationwide reduction of the concentration of ground level ozone to levels below the threshold at which the most susceptible segments of the population experience health effects from smog. For its part, the CCME is finalizing a comprehensive ten year national plan to manage emissions of NOx and VOCs. The plan aims to reduce emissions in problem areas by 50 percent.

Recognizing that Canadian actions alone are not sufficient to reduce toxic air pollution, the federal government has promised to pursue negotiations with the United States under a transboundary air quality accord to incorporate both countries' commitments to controlling the flow of toxic air pollutants and VOCs.

OTHER COMPLEX POLLUTANTS

Many other complex pollutants emitted into the air are not monitored by existing networks, and these may become the focus of pointed public attention. These pollutants could include lead, cadmium, PCBs, dioxins and mercury from incineration. While the reduction of nitrogen oxides and hydrocarbons is being addressed by the CCME, better appreciation of other pollutants Canadians breathe is also needed.

A prototype initiative might be Ontario's clean air program, which proposes stringent emission reductions while including initiatives to classify contaminants in terms of level of hazard, and to develop ambient air standards for 400 contaminants. Currently undergoing public review, this program will require contaminant emission reductions which could cost $6-billion in the next ten years to achieve. The principal elements of the program are to:

- impose direct emission limits, achieving bottom-of-the-stack controls;
- classify contaminants in terms of the level of hazard each poses and develop graduated levels of control based on hazard; and,
- develop ambient air standards for 400 contaminants as a "second line of defence" for air quality control.

AIR QUALITY INDICES

In many areas of the country, the immediate health risks of poor air quality are not addressed adequately. The data on concentrations of air pollutants collected by the NAPS network are not published for three to four years. There is no national air quality index to which these concentrations can be applied in order to inform the public immediately on the quality of their urban air. The province of Ontario and some large urban regions such as the greater Vancouver regional district and the Montreal regional district monitor air quality in addition to the NAPS network and apply these measurements to an air quality index. These provincial and regional indices, however, are not nationally uniform.

WASTE INCINERATION

Canadians are greatly concerned about the potential threats to air quality and human health from waste incineration. Incinerators are seen as a source of airborne dioxins and furans. They are also blamed for large emissions of mercury, cadmium and lead from batteries and other industrial/ commercial sources.

This concern is impeding the development and implementation of waste incineration technology. Citizens in B.C. halted a proposed hazardous waste facility supported by the provincial government. In Ontario, doctors and citizens in Orillia stopped a proposed incinerator designed to handle Metro Toronto's garbage — after Orillia's mayor and council had tentatively accepted the proposal. The Ontario government has now promised to ban all garbage incinerators in the province. Citizens in West Lincoln and Niagara Region are currently attempting to halt a proposed toxic waste processing facility which includes an incinerator. The Decom incinerator in Quebec, used to burn medical wastes, has been the subject of much public scrutiny and upgrade requirements.

The use of Refuse-Derived Fuel (RDF) and Waste Derived Fuel (WDF) in cement kilns is being touted in North America as a partial solution to the waste crisis. However, contrary public reaction has been strong. In Ontario, local residents around the St. Lawrence Cement kiln where hazardous industrial waste from the U.S. has been burned for years, have identified what they think is a "cancer cluster" downwind from the kiln. Residents around the St. Mary's Cement kiln oppose the burning of tires for waste derived fuel.

Waste incineration is a significant component of the current mix of waste management technologies. For the destruction of some hazardous wastes, incineration may be the most appropriate option, if regarded as a transitional technology until the volume of toxic wastes being produced is curtailed and existing wastes are destroyed. This much is clear: jurisdictions must work together to develop and implement safe and acceptable waste management technologies.

3. WATER ISSUES

Water is Canada's most abundant natural resource. It is also the most taken for granted, the most abused and probably the most undervalued. With increasing local, regional, continental and global pressures (e.g., global warming) in the 1990s and beyond, the strategic significance of Canada's inherited natural water wealth will become more obvious nationally and internationally.

As a common property resource, water is owned by everyone, yet belongs to no one. Its "management" and care are both facilitated and frustrated by individual property law; riparian rights; aboriginal rights; transboundary agreement;, municipal, regional, provincial and federal jurisdictions, and even the Canadian constitution. At the federal and provincial/territorial level, water-related issues are further complicated by competing departmental mandates. In all this, there is no systematic accounting for the use and abuse of this resource, despite its role as "the lifeblood of the environment". A more comprehensive system for dispute resolution and a more consistent management regime will be required in the 1990s.

Our aquatic ecosystems are under stress because of manmade inputs from both land and air. Some of the most pressing problems include: discharge of untreated sewage; discharge of industrial waste products, including persistent toxic chemicals; physical degradation, such as wetland drainage and siltation; contamination of groundwater from agro-chemicals and toxic waste storage sites; and chemical loading from the long range transport of airborne pollutants.

Because the hydrologic cycle is driven by energy from the sun, the impact of global warming in the 1990s and afterwards will be most evident in the availability and distribution of water in Canada. Major regional shortages are being forecast which, in turn, will affect everything from agriculture and municipal supplies to hydroelectric power generation and manufacturing. These shortages could lead to serious social and economic dislocations.

URBAN WASTEWATER

Canadians use their waterways to dump many wastes, and depend on the same watercourses for much of their drinking water. Seventy percent of Canada's 26 million people live in cities and towns, making municipal wastewater the largest polluter in the southern part of Canada. Approximately half of Canada's urbanized population (53 percent of people in communities over 1,000) is served with secondary sewage treatment or better; most of this occurs in Ontario.

Another significant source of urban wastewater is storm runoff, which contains many varied pollutants. The contents of stormwater include airborne pollutants (e.g., dust and lead), rubber particles from automobiles, asbestos fibres from brake linings, animal droppings, lawn fertilizers, leaves and lawn clippings, salt, and general litter. Untreated sewage is often added to stormwater runoff, because storm and sanitary sewers are often combined. When the flows exceed the capacity of the treatment plant, such as during a rainstorm, the excess is released without treatment. Thus, in many urban centres water bodies are closed to swimmers after rainstorms.

The treatment of urban wastewater is becoming more complex due to the more than 30,000 different chemicals that are available on the Canadian market. Experience across Canada has shown that many of these chemicals end up in municipal treatment facilities that are not capable to deal adequately with them. As a result, these substances often enter the aquatic ecosystem, where they accumulate.

INDUSTRIAL EFFLUENT

Most industries require water and discharge wastes into water bodies, landfill sites or the air. Industrial wastes disposed of on land add toxins to a landfill's leachate (liquid runoff), which can leak into groundwater and nearby water bodies. Pollutants discharged into the air can be transported long distances, eventually to fall as chemical precipitation. The natural functioning of the hydrological cycle assures us that these pollutants will eventually become part of the aquatic ecosystem. For example, acid rain has killed more than 14,000 Canadian lakes as the result of the long range transport of air pollutants. As well, the once pristine regions of the high Arctic now contain measurable levels of substances originating from as far away as Eurasia.

Industrial wastes are either rich in organic matter that lower oxygen levels when discharged into water and kill aquatic organisms, or contain chemicals that are lethal to aquatic organisms or accumulate in the food chain making fish unfit for human consumption. Sources include unauthorized discharge through municipal sewage systems, releases from mine tailings ponds, seepage from old coal tar sites and leaking underground storage tanks. One of the most important, however, is effluent from pulp and paper mills.

PULP AND PAPER DISCHARGE

The pulp and paper industry is of critical economic importance to Canada. Its mills are also the largest industrial sector polluters. Considerable progress has been made over the last decade in reducing the Biological Oxygen Demand (BOD) of their effluent. Recently, attention has been focussed on the persistent toxic substances in pulp mill effluent, particularly organochlorines such as dioxin and furans.

In British Columbia, such effluent has caused the closure of numerous fisheries. In 1990, affected areas had increased as much as five times in extent and were subjected to new restrictions, despite the fact that many B.C. mills have substantially reduced their dioxin and furan emissions. In Ontario, concern has focused on the nine mills producing bleached kraft pulp. Based on the 1988 report "Kraft Mill Effluents in Ontario", the Ontario Ministry of the Environment issued new control orders for these mills, requiring them to further reduce their dioxin and furan emissions as a five year interim measure until the more stringent Municipal/ Industrial Strategy for Abatement (MISA) regulations are implemented. CCME has announced its commitment to developing a national regulatory strategy for controlling water pollution from pulp and paper mills.

During the 1990s in Canada, it will be virtually impossible to construct or expand pulp and paper mills without comprehensive environmental assessments. One of the most important considerations will be the nature of the effluent discharges, particularly related to the persistent toxic substances. Although the issue is being addressed by the industry with encouraging results and by CEPA, it is clear that the issue will continue to be controversial. The Korean group, Shin Ho experienced this controversy recently in Thunder Bay and the Japanese-led Alberta Pacific consortium in northern Alberta is another case in point.

Changes to plant processes such as chlorine dioxide substitution appear to be effective as a means of reducing the formation of many persistent organic contaminants. Additional major reduction in BOD5 would benefit local water quality and should further reduce the release of persistent organic contaminants.

DRINKING WATER

Water means life — a cliché that is literally brought home to Canadians daily in their tap water. Although public and private sector efforts to control pollution and provide safe drinking water have increased in recent decades, there is a growing perception by users that public water supplies and in many instances private wells are adversely affecting their health. As a result, sales of bottled water have doubled in the last eight years. Quebecers buy twice as much per capita as other Canadians. And sales of home treatment devices including filters have sky-rocketed. None of these measures assure, however, improved safety over what comes out of the tap.

The value of urban water treatment and delivery systems in Canada totals about $100-billion. While the water is delivered for many purposes, it all meets the standard of the most stringent use — that of drinking water. Indeed, much less than one percent of the water produced is actually used for drinking purposes. Toilets use nearly 25 percent, and during the summer about half of all treated water is sprayed onto lawns.

Most consumers judge their water on its aesthetics: how it looks, tastes or smells. Unfortunately, most of the substances that are hazardous to health are not detectable by any of the senses. Few if any of the treatment plants in Canada (or elsewhere) are able to remove these "invisible" substances from raw water. And while it is true that testing laboratories can detect organic and inorganic substances in most water supplies, there is wide disagreement about their effects. This includes the effects of chemicals used in the treatment process itself, such as chlorine.

The lack of regulation of the booming bottled water and home filter industry has received a great deal of attention. The lack of any laws governing the safety of tap water has also been criticized. The closest Canada has are "guidelines" developed by a federal/ provincial working group. Even as guidelines, they do not cover important industrial chemicals. The limits specified are, in themselves, difficult to establish and controversial even in the scientific community. This is illustrated by the allowable levels of trihalomethanes (THMs), a group of carcinogenic and mutagenic chemicals produced by the reaction of chlorine to breakdown products from decaying plant and animal material in water. Canada allows 2.5 times more than the United States, ten times more than the World Health Organization and 350 times more than West Germany!

It is clear that in the next decade there will be a growing need to restore public confidence in water supplies. Pollution prevention at source — stopping the use of waterbodies as sewers and the discharge of contaminants into the air — is part of the solution. But more direct action through enhanced treatment technology and clear performance standards will be necessary. The recent federal Green Plan promises a Drinking Water Safety Act in 1991. While its application will be limited to federal jurisdictions such as national parks and Indian reserves, it will, undoubtedly, stimulate regulation in other jurisdictions.

WATER PRICING / WATER CONSERVATION

Canadians are among the world's most wasteful users of water; they also pay the least for it. In the ten year period to 1981, water withdrawls in Canada increased by over 50 percent. The population increased only five percent in the same period.

Charging for the use of any product, including water, is recognized as one of the best ways to control demand and to encourage efficiency of use. The "user pay" or "full-cost pricing" approach applies as much to agricultural (irrigation) and hydro use as to domestic use. Although the concept is not new, a more rigorous and consistent application in all Canadian jurisdictions will likely be in the forefront of water issues during the 1990s. Implementing a more comprehensive water pricing regime will create incentives to avoid waste, reduce pressure on the resource and the environment, generate revenues to cover direct and indirect costs, ensure more equity among users and increase public awareness of water's value.

Even though it is recognized as a subject over which provincial and local governments exercise jurisdiction, "realistic pricing" is the first of the five strategies that constitute the backbone of the federal water policy. It is also a feature of the government's Green Plan. And water pricing is currently the subject of numerous provincial, municipal and private sector studies. For example, a comprehensive analysis by the Canadian Water and Wastewater Association and the Rawson Academy of Aquatic Science, scheduled for completion in the spring of 1991, will result in a manual outlining the application of new pricing regimes for urban water services — pricing strategies which realistically reflect fully allocated costs. As a result of such work, there should be greater unanimity emerging as to the functions of water rates, the methods for defining or determining different aspects of use or operations, the strategies for setting rates, and the accounting and cost allocation methods for new rate structures. The users of urban water and wastewater services (the majority of Canadians) will be the first to see and feel the effects.

WATER EXPORTS

Over 60 percent of Canada's freshwater drains north where many politicians, engineers and others see it as "wasting its way to the sea." With water demands growing in the south, this "untapped supply" will continue to keep diversions and exports on regional and national agendas. The effects of global warming will only increase the intensity of the resulting debates. Large scale water diversions are not new. With more than 600 dams and sixty large domestic interbasin diversions, Canada diverts more water than any other country in the world. During the Free Trade debate, however, a Gallup poll showed that Canadians consider water to be our most precious natural resource — more important than the next two resources combined (agricultural land and forests, both of which depend on water). Sixty-nine percent of Canadians disapprove of exporting water to the United States. The basis for serious tensions throughout the 1990s and into the 21st century is obvious.

Over the last several decades there have been nine proposals for large scale interbasin water exports to the United States, with project costs ranging from $30- to over $150-billion dollars. There has also been recurring talk of southward diversions from the Great Lakes (usually through the Chicago Diversion) plus numerous tanker bulk export proposals. Many of these export ideas persist despite the lack of government endorsement on either side of the border. And whatever the economics or technical feasibility of these proposals, there can be little doubt that they excite public passion across Canada.

Smaller scale water exports, such as those being proposed on the west coast to deliver bulk water to the United States by ocean tanker, will likely require decisions in the early 1990s. This kind of export is not prohibited under federal or provincial law or policy. What remains to be clarified is how the approvals will be granted, including the environmental approvals. Thorny questions have been raised from aboriginal water rights to the compatibility with the Free Trade Agreement of British Columbia's regulation establishing a higher price for water exports than for water used domestically.

4. LAND ISSUES

The key environmental protection issues related to land are (i) agriculture and its effects on the environment, (ii) solid wastes, and (iii) hazardous wastes.

Agriculture raises several concerns: soil conservation, the preservation of the productivity of the soil for future generations; environmental damage, the effect that agricultural practices have had on other resource stocks such as wildlands, parklands and waters, and on human health; and damage that other economic sectors may inflict on agriculture. These issues are discussed in the section on Renewable Resource Management, below.

SOLID WASTES

Fifteen years ago, the Science Council of Canada's report Towards a Conserver Society argued eloquently that the attitudes — of individuals, businesses and governments — concerning the consumption of material goods had to change. Triggering this change remains a major social challenge. Waste disposal is rapidly becoming the most critical issue faced by governments in larger, growing municipalities. Quite simply, we are running out of space to bury our garbage. According to the Green Plan:

Canadians produce over 30 million tonnes of garbage annually, or more than a tonne of garbage for every man, woman and child. We recycle only ten percent of our garbage and send most of the remaining to our rapidly filling landfill sites.

The waste problem is exacerbated by rising disposal costs and increasing fiscal restraint. For example, in the United States, landfill costs for hazardous wastes rose from around $80 per tonne at the beginning of the 1980s to around $225 per tonne by the end, with the main increase being in costs of treatment rather than dumping. Incineration costs have probably risen still faster. [14]

This issue is a consequence of demographic and social trends. The rapid growth of urban centres, coupled with changing lifestyles and consumer tastes, has encouraged a high-consumption, quick-use and disposal-oriented society which produces enormous quantities of garbage and recycles little. Resolving the issue requires more than finding new landfill sites to which garbage can be trucked, or building more incinerators. It also requires going very much further than blue-box recycling programs. It demands a basic restructuring of social values related to consumption and waste, concurrently with effective, region-wide waste management strategies. Such strategies must be based on widely agreed objectives and standards, including measures such as controlled urban growth, in order to minimize waste generation.

Table 3

INTERNATIONAL COMPARISON
Annual Municipal Waste Generation 1987

COUNTRY	MUNICIPAL WASTES KILOGRAMS PER CAPITA
Canada	630
United States	762
United Kingdom	313
France	272
West Germany	317
Italy	263
Japan	344

SOURCE: World Resources Report, 1990-91. Washington: World Resources Institute

Municipalities which generate garbage are the principal "owners" of the problem, and it can be massive. In 1988, the Toronto Metro Works Department, which disposes of solid waste on behalf of the regional municipalities of York and Durham as well as Metro itself, handled 1.3 million tonnes of garbage annually, or one and a quarter kilos daily for each man, woman and child in the area. Yet, while responsible for solid waste, municipalities usually have little control over underlying causal factors such as population growth and changes in consumer demand.

Packaging is the single largest component of solid waste. In 1986, one-third of all of the municipal solid waste in the United States consisted of packaging. [15] In March 1990, CCME ministers endorsed a National Packaging Protocol for reducing packaging by 50 percent by 2000. A 20 percent reduction target from 1988 levels by 1992 was also approved. In the Green Plan, the federal government announced a number of initiatives designed to achieve a national goal of cutting waste by 50 percent by 2000. These initiatives include:

- by 1993, standards and regulations to reduce waste from packaging materials;
- by 1994, national standards, codes, policies and regulations for the other components of the waste stream;
- support for technological innovation; and
- expansion of the National Waste Exchange Program.

HAZARDOUS WASTES

According to the federal government's Green Plan, hazardous wastes make up about 20 percent of Canada's waste management problem. Apart from taking up space, the disposal of these wastes in landfill sites and accidental spills have caused serious and expensive land, water and groundwater contamination problems across the country. Many sites where such wastes have been placed are not being dealt with, or are unknown.

As well, the federal Green Plan states that Canadians continue to produce eight million tonnes a year of hazardous waste and only 40 percent of it is treated. In some cases, hazardous wastes are being stockpiled, awaiting the development of safe destruction technologies or construction of suitable waste management facilities. As described previously with respect to incineration, public concern related to hazardous waste management in general, coupled with lack of public and private sector commitment, is making the development of new technologies and the placement and operation of sorely-needed facilities difficult.

Fresh water is our lifeblood. It is considered by most Canadians to be the sacred depository of our identity and of our future.

- Peter C. Newman

Clearly, management of hazardous wastes must begin with controlling the types of new chemicals and products being introduced. There is a need for strong regulatory programs at both the federal and provincial levels to control toxic substances before they become wastes. This must be accompanied by appropriate and effective control through all other phases of their lifecycle.

Non-regulatory approaches such as public education, economic incentives and research and development are important but do not replace the need for effective government response to the hazardous waste problem.

According to the Green Plan, complementary federal and provincial regulations and co-operative agreements are in place to control the handling, storage, disposal and destruction of hazardous wastes in Canada. Full implementation of these control measures, however, is awaiting decisions by the provinces on the location of new hazardous waste destruction facilities. In the meantime, existing treatment and destruction facilities are having to handle larger amounts of wastes.

Under the Green Plan, the federal government proposes to take further action to reduce the generation and ensure the safe transportation and disposal of hazardous wastes in Canada by:

- destroying all PCBs under federal jurisdiction by 1996;
- completing, with the provinces, regulations and guidelines for the safe management of hazardous waste streams, including reduction, re-use, recovery, recycling and transportation, by 1996; and,
- supporting technology aimed at reducing, recycling and re-using hazardous wastes, or their safe destruction.

The federal government currently relies primarily upon the CEPA and the Pest Control Products Act to identify and regulate toxic substances. CEPA is intended to manage toxics throughout their lifecycle but the pace of assessment of priority substances and regulation development under CEPA is slow. Notwithstanding these difficulties, some comments made previously are particularly relevant: decisions we are making now about the introduction, management and clean-up of toxic substances in the environment are premised on poor understanding of their full effect on ecosystems.

CONTAMINATED SITES

Particularly worrisome are abandoned or "orphan" hazardous waste sites. The "polluter pay" principle as applied to the clean-up of hazardous waste is effective only where a polluter, owner or operator can be identified and liability assigned. When sites have been abandoned or the owner/ operator is identified but is insolvent or has only limited responsibility for the contamination, the financial burden of cleaning the sites falls to the state.

One way governments can deal with this eventuality is to establish a "superfund", a fund either earmarked in general revenues or created by a specific tax on industry. The best known example is the U.S. Superfund, under the 1980 Comprehensive Environmental Response and Compensation and Liability Act (CERCLA), and its 1986 amendment, the Superfund Amendment and Reauthorization Act (SARA). The $8.6-billion U.S. Superfund, with an additional $500-million for leaking underground storage tanks, is created primarily from a tax on the chemical and petroleum industry. The EPA is authorized under CERCLA to arrange for or to enforce the clean-up of hazardous waste sites and to claim reimbursement for costs after clean-up is completed. CERCLA provides for ranking sites on the National Priority List (NPL); a tax structure to finance the Superfund; enforcement powers to order clean-up of NPL sites; assessment of liability for reimbursement of costs; and, penalty provisions for uncooperative responsible parties.

In October 1989, the CCME undertook to restore contaminated sites in Canada in conformity with the "polluter pay principle." A joint federal-provincial program totalling $250-million was proposed with $200-million earmarked for decontamination and the remaining $50-million for development and testing of decontamination technology. In the Green Plan, the federal government has since committed itself to work with the provinces and territories on agreements for implementing the program; for clean-up of 30 high-risk contaminated hazardous waste sites by 1995; and, for support of new technologies for site clean-up.

The program is specifically designed for orphan sites where contamination poses an immediate health hazard. Clean-up costs are to be shared equally between the federal and provincial governments. At present, there are approximately 1,000 listed hazardous sites in Canada, 50 of which are abandoned. The success of this proposed program is dependent, however, upon provincial promulgation of laws and regulations enforcing the clean-up of hazardous sites. This provincial role requires uniform criteria for the evaluation, ranking and restoration of riority orphan sites; and for the assumption of provincial and federal responsibility for those contaminated sites that are government owned.

In Quebec, the Commission d'enquête sur les dechets dangereux (the Charbonneau Commission) has proposed that the province set up a rehabilitation fund for the clean-up of hazardous sites, funded 65 percent by a tax on corporate income and 35 percent from general state revenues. The Commission also recommended the creation of a fund for particular sites, such as a fund for mining operators to ensure closure and stabilization of land used as a depository for mine tailings, and an obligation for aluminium foundries to restore former dump sites. None of these recommendations has been put into practice at this time.

In Ontario, the new Bill 220 amendment to the Environmental Protection Act, passed on June 28, 1990, greatly expands the decontamination powers of the provincial Ministry of the Environment (MOE). The amendments were enacted in part as a response to the recent fire at a tire dump in Hagersville, which burned for days and released toxic smoke and oils into the air, soil and groundwater. Under Bill 220, MOE can issue clean-up orders to any person who causes or permits the discharge of a contaminant that presents a danger to health or the environment. Where private restoration of a site is impossible or not forthcoming, MOE can clean up the site and seek reimbursement from the responsible party. Although the decontamination powers of MOE have been favorably expanded by Bill 220, no provincial fund has been established for the restoration of abandoned or insolvent sites.

5. EMERGENCY PREPAREDNESS

Recent emergencies of human origin include the PCB fire at St.-Basile le Grand, the Nestucca oil spill on the west coast and the tire fire at Hagersville. An estimated 10,000 smaller spills of oils and other hazardous substances occur every year in Canada. [16] Natural emergencies are also frequent and dramatic — tornados, forest fires threatening remote communities, earthquakes, and gales affecting shipping and coastal populations.

Environmental emergencies raise several issues. The first is that of prevention.

Prevention of accidents is obviously preferable to having to react to them. In November, 1990, the report of the Public Review Panel on Tanker Safety and Marine Spills Response Capability made 107 recommendations with an overall emphasis on spill prevention. One recommendation was the replacement of the entire fleet of Canadian tankers and tank barges with double-hulled vessels. Recommendations concerning spill response focused on better response planning, coordination, cooperation between industry, governments at all levels, and the coast guard. Much tighter standards and closer monitoring are another aspect of prevention.

The second issue is response capability. While some emergencies may present no serious threat, others may be beyond present capabilities to control (viz., the Exxon Valdez spill). Inability to deal with oil spills of significant magnitude is noted in the earlier section on Marine Environmental Quality. It took 17 days to put out the Hagersville tire fire. This was something of a record as similar fires have burned for months. Response capability must extend well beyond the immediate disaster. In the case of Hagersville, follow-up has involved cleaning up the 4.6 hectare dump itself, ensuring that soil and aquifers are contamination free, and safely disposing of the 56 million litres of oil (more than was spilled from the Exxon Valdez).[17]

A third issue is who should bear the costs when accidents occur. While it is accepted that the public cannot be saddled with the full costs of natural disasters, the matter is different when disasters are manmade. The Green Plan states the federal view that there must be adequate compensation when Canadians are directly affected by marine pollution incidents, and that compensation coverage for the Arctic must be improved.

Coping with emergencies is primarily a local and provincial responsibility, with federal involvement by invitation from provinces. The federal government has primacy in dealing with emergencies only if federal lands are involved or if the emergency has international implications. With the growing complexity of human activity, and perhaps an increasing risk of disasters, a pertinent question is how best to arrange an effective national prevention and response system.

The CCME has drafted a "Memorandum of Understanding for Environmental Emergencies" to promote cooperation in the exchange of information, assistance in abatement and clean-up, and the lending of resources to aid an affected province. Essential lists of contact personnel and available resources across the country are a part of this Memorandum.

6. SCIENTIFIC RESEARCH

Most environmental problems of regional, national or international significance will only be resolved successfully by addressing them in the context of the ecosystem in which they occur. This realization has two major implications for policy-making and scientific research. First, despite their internationally recognized pioneering work, Canadian scientists are just beginning to understand how ecological systems function and what keeps them healthy. Within the scientific community, it is therefore understood that many of Canada's environmental legislation, regulations, policies and programs are based on ecologically-limited or questionable assumptions.

Second, a greater scientific research effort needs to be mounted to create the knowledge base to address current and future issues. Although the rising cost of remedying environmental degradation makes the need to implement economically-efficient solutions increasingly urgent, the financial commitment to long term scientific research is diminishing. Because the dividends of scientific research take many years to accrue, the environmental, social and economic benefits of this research are rarely linked to the prior investment made or to the remediation of current problems. The result is that the scientific effort is weakened, particularly in times of budgetary restraint. This weakening undermines sound public policy-making and, ultimately, the protection of environmental quality. It also locks policy-making into a reactive, rather than a preventive, approach.

Fortunately, the elements of an ecosystem-oriented and integrated natural and social science program already exist in Canada within governments and universities and, in specific instances, in the private sector. What is lacking is a nationally-coordinated program to muster and orient this scientific expertise. An important step toward such a program was taken in October, 1990 when the Canadian Environmental Advisory Council (CEAC) organized a workshop of Canadian and American ecologists, environmental scientists and policy analysts to define the nature of a national ecosystem research institute.

The Green Plan recognizes the need to increase the scientific research effort and proposes a five-year environmental science and technology action plan. It does not commit the federal government, however, to a scientific research program based on an ecosystems approach.

RENEWABLE RESOURCE MANAGEMENT

1. FORESTRY

Canada has approximately 453 million hectares of forest land and one of the world's largest forestry industries. This country possesses ten percent of global productive forests and 25 percent of the world forest market. During the 1980s, approximately 650 million trees were harvested annually, resulting in direct forest industry employment of nearly 270,000 people. In 1989, the export value of Canada's wood, wood products and paper totalled $23-billion.

The economic importance of the forestry industry has overshadowed the ecological importance of forest ecosystems. Management of the industry is predominantly characterized by practices that maximize the value of lumber and ignore the value of the forest as habitat for wildlife, a purifier of air and water, a windbreak across flatlands and protection against erosion and flooding.

The primary method of harvest is the clear-cut, accounting for 90 percent of all logging. The main advantage of clear-cutting is that it best satisfies the economic goal of least cost for maximum dollar return. Each year, approximately 800,000 hectares of softwood species are logged by clear-cut, while only a portion of this harvested land is re-seeded. Less than 50 percent of clear-cut land regenerates naturally to return to a commercially viable forest, and this only over a long time. And 200,000 to 400,000 hectares of forest land will be covered indefinitely with dead timber or non-commercial species. When added to losses due to fire and disease, Canada is annually losing nearly one million hectares of coniferous forest to unstocked or unproductive land.

There is also increasing concern that the present level of harvesting cannot be maintained. Significant shortages of timber are now reported in every province. According to forestry experts, both the clear-cut harvesting method and lack of sustainable management practices have brought about these shortages. To combat depletion, reforestation has increased from 200 million to approximately 750 million seedlings annually. In spite of this increasing effort, the area insufficiently restocked is increasing by 200,000 hectares each year. Due to a diminishing stock, Canada's annual allowable cut ("AAC", defined as the volume of wood that can be harvested without endangering the resource) has dropped steadily from 256 million cubic metres in 1970 to 228 million in 1981 to 204 million in 1986.

Dr. Peter Pearse, a forestry and fisheries expert, when testifying before the House of Commons Environment Committee characterized the problems with current forestry management as follows.

> *Forestry especially is based on some three centuries of doctrine on sustainable yield. So you may ask why then are these resources so badly managed and why are the world's fisheries and forests being depleted. The answer is not because we do not know how to do better. It is because we have built in obstacles to better management in the form of market incentives to do otherwise, in institutional arrangements that contribute to that, in the form of government policies that promote over-exploitation, and in the failure to develop property rights that will protect these resources.* [Emphasis added]

It is not simply the inability to replace a tree for a tree that has led to resource depletion. Over-exploitation is compounded by a market-driven economy which fails to account for the hidden costs of environmental degradation. Each province and the federal government has a forestry act. Most of them, however, do not require sustainable development practices that maintain, in addition to a sustainable yield of the crop, a sustainable future for multiple use and the many essential ecological roles that the forest plays.

NEW FOREST MANAGEMENT TECHNIQUES

Future forest management techniques will have to recognize that forestland is no longer purely a source of timber but a resource of multiple uses. After a century during which the rate of harvest well exceeded the rate of growth, new management techniques must eliminate the economic incentives that encourage destruction of the resource. One way in which to accomplish this is to price the resource to eliminate its wasteful or unnecessary use. A second way is to require less destructive harvesting techniques.

A very acrimonious forestry issue is the logging of the old growth forests. The world's greatest temperate rainforest extends from Alaska to California. Many of these trees range from 500 to 2,000 years old. Although not as diversified as the tropical rainforest in the number of plant and animal species, this temperate forest is the most productive forest ecosystem in the world. Estimated biomass of the temperate rainforest reaches 1,163 tonnes per hectare in regions along the coast of British Columbia, compared to approximately 415 tonnes per hectare for stands of mature tropical rain forest. In addition to its productivity, the old growth forest provides habitat for numerous species of plants and animals.

Regeneration of these forests is difficult at best. Poor soils and the dependency of the old growth forest on the recycling of its own organic matter into the nutrients that it needs may make regeneration impossible.

The issue is complicated by protracted battles between the timber industry, environmentalists and government over the appropriate level and method of harvesting, as exemplified by the recent Carmanah Valley forest dispute. Although logging of old growth forests poses many of the same resource management questions as that of regenerated forestland, the disappearance of old growth forest places heightened emphasis on the desirable balance between economic necessity and environmental preservation.

THE GOAL OF MULTIPLE USE

The principle of multiple use recognizes that every Canadian has a stake in the health of the forest sector. The principle requires that Canada's forests be used to benefit all Canadians and to produce a variety of goods and services including timber, water, recreation, wilderness, wildlife habitat and protection against climatic change. Indirect costs such as contamination of air and water must be accounted for in assessing the benefits of resource exploitation.

> *The era of the Canadian forest as the exclusive domain of the forest industry has ended. In today's increasingly mobile and environmentally sensitive society, there are a number of other publics who hold other values, and these demands must be harmonized into federal forest policy. Only through a broader and more enlightened strategy on the part of the federal government may the needs of the many sectors be satisfied.* [Emphasis added.] [18]

The Canadian Council of Forest Ministers recommends that the objectives of the World Conservation Strategy be implemented on the provincial level with assistance from the forest industry itself. The Council has acknowledged that:

> *guidelines for forest wildlife management have not been given sufficient attention, nor has the equitable distribution of costs involved in obtaining multiple benefits from integrated forest wildlife management.*

To remedy past practices, the Council recommends that:

- planning processes be fostered that encourage the...management of...non-timber values such as wildlife, fisheries and recreation; and
- allocations to exclusive uses be subjected to rigorous cost/ benefit analysis.

The duty to foster multiple uses of forestland through improved management techniques is thus a part of our national and provincial forest policies.

2. PARKS AND PROTECTED AREAS

Wilderness areas increasingly are being lost to development: according to the federal government, the amount of wildlands in Canada has declined by four percent in the last 15 years. As a result, the diversity of natural ecosystems is being lost, and the plant and wildlife species that inhabit them suffer. The Atlantic hardwood forest has been lost and almost 90 percent of the Carolinian forest. According to industry estimates, two-thirds of the Pacific coastal rainforest has disappeared.

Among other things, protected areas provide scientific benchmarks against which environmental change and degradation can be measured. Because of its size, Canada possesses a large diversity of natural regions — an estimated 350 for the country as a whole. As of May 1990, these regions were mapped out in all jurisdictions except the Northwest Territories, Prince Edward Island, New Brunswick, and Newfoundland. To preserve the full range of Canada's diverse ecosystems, at least one representative area in each natural region would have to be established.

In 1987, the federal task force on national parks advised the federal Minister of the Environment that "the possibility of dedicating wilderness lands to conservation will have all but vanished by the year 2000." To complete the national park system, 18 new parks will be required. The federal government has committed itself to completing the national park system by 2000 and creating five new parks by 1996. This federal contribution will likely cover about one-quarter of the territory requiring protection across Canada.

The provincial protected area system is also incomplete. In Quebec, for example, ten of the 43 natural regions have protected areas, and in Ontario 32 of the 65 natural regions are represented. To date, Canada as a whole has protected representative samples in a little less than one-third of its natural regions. Although there are over 7,000 private and government-owned protected areas in Canada, few are large enough to meet the ecological requirements of the species they support.

So far, Canada has protected only 3.4 percent of its landmass from exploitive activities (logging, mining and hydro) compared to the notional 12 percent of the lands and waters suggested in Our Common Future, the report of the World Commission on Environment and Development. The federal Green Plan establishes as Canada's long term goal the protection of 12 percent of the country.

Of parallel concern to the establishment of protected areas is their management. Many existing parks and protected areas are becoming natural islands in a sea of development. Parks often do not include the total range of species because they are not large enough to protect their natural ecosystems from outside influences or have too many interactions with human activities. Since all species interact with and depend on other species, the absence of certain species may cause other wildlife populations to suffer and even collapse. A 1986 study of 14 western North American national parks found that only one area, Canada's four mountain national parks, did not experience any loss of large mammals. Because few agencies responsible for the management of protected areas have consistent monitoring and inventory programs, it is very difficult to know whether they are meeting their mandates.

As wilderness areas become more scarce, land use conflicts will become exacerbated. These conflicts will be extremely difficult to arbitrate on a case-by-case basis because the values at stake are not comparable (e.g., wilderness vs the present value of an ore deposit) and the government's disposition of these lands is widely perceived as both a zero-sum game and a possible precedent for future action. The practice of permitting industrial activities in or adjacent to protected areas will be a contentious issue, as will the further development of tourist facilities in or near these areas. The public is likely to look to its environment ministers to ensure that the health of protected areas is secure, even when another minister may be responsible for the issue.

3. BIODIVERSITY

The diversity of living things plays a vital role in the ecological and biological processes that are essential to life itself. Wild species of plants and animals still provide many of the basic ingredients of our medicines, and the gene pool of the world's species continues to be important to agriculture and to the supply of raw material for genetic engineering. The protection of biodiversity is, therefore, a global imperative today. Biologists estimate that humans destroy from one to three species per day, with some predicting that by the end of the century the rate will accelerate to one per hour, and up to 15 percent of all species now on earth will be gone.

Canada's biodiversity contributes directly to its social and economic well being. In 1981, Canadians spent $4.2-billion on wildlife-related activities, supporting 185,000 jobs, and contributing $5.2-billion to the Gross Domestic Product (GDP) and $2-billion to government revenues. Since the arrival of the Europeans, nine of Canada's distinct populations of animals have become extinct. One hundred and ninety-two Canadian species are currently listed as threatened, endangered or vulnerable. Given that Canada is a northern country with relatively little biodiversity, 192 species is a significant portion of our total biological endowment. Along with the Europeans have come several non-native species of plants and animals. These exotic species have disrupted many of our native ecosystems and usually lead to a decrease in biodiversity. Since exotic species have no natural predators in our ecosystems, they can out-compete and thus out-reproduce native species, as well as decimate the populations of species they feed on.

For example, the introduction of the sea lamprey into the Great Lakes, along with pollution and habitat destruction has led to the total collapse of lake trout populations and the commercial trout fishing industry. These populations have never recovered and the programs to eradicate the sea lamprey cost those jurisdictions surrounding the lakes millions of dollars per year.

Exotic species continue to be introduced into Canada with severe consequences. The zebra mussel in the Great Lakes is the latest example. This species of clam was introduced into the Great Lakes when a foreign ship discharged its ballast. It is rapidly spreading through our largest freshwater ecosystem, clogging water intake pipes, fish spawning beds and invertebrate feeding appendages. The zebra mussel will once again change the species make up of the Great Lakes and will likely result in the loss f more of our native species.

Protecting threatened species will entail more then merely restricting hunting, fishing, and trapping. Today, whole ecosystems, not just a few species within them, are endangered due to the threats of habitat destruction and environmental contamination. Both these hazards, especially contamination, are concerns for the CCME. As these hazards are increasingly linked to reduced species diversity, public demands to curb pollution and habitat destruction will increase, and these demands will be directed towards environment ministers and their departments.

4. AGRICULTURE

Agriculture raises several environmental issues: soil conservation, the preservation of the productivity of the soil for future generations; environmental damage, the effect that agricultural practices have had on other resource stocks such as wildlands, parklands and waters, and on human health; and damage that other economic sectors may inflict on agriculture.

SOIL CONSERVATION

Two factors affect the preservation of the productivity of soils: economic circumstances and farming practices. Economic circumstances are illustrated by the use of subsidies to produce agricultural goods even when there is no market demand for them. The effect of farming practices can be exemplified by "summer fallowing", which though time-honoured, is now believed to be largely responsible for the decline in the organic matter in soils, increased soil erosion and an alarming increase in salt-affected land in the southern prairies. Both economic factors and agricultural practices have led to soil degradation — erosion and the loss of soil organic matter, chemical deterioration, and physical deterioration. [19]

ENVIRONMENTAL DAMAGE BY AGRICULTURE

The Inquiry on Federal Water Policy (1985) identified agriculture as the major source of non-point pollution of water, with soil erosion by both water and wind of particular significance. The expansion of farmland, the widespread use of chemical fertilizers, herbicides and pesticides, and the deposition of topsoils in ditches, streams and rivers have resulted in damage to lakes and waterways in the form of sediment loadings and chemical contamination. The results have been an extensive requirement for dredging, loss of wetlands and fish stocks, and increasing costs of treating water for human and industrial consumption.

The loss of wetlands due to drainage for agriculture is a major problem. On the prairies, the rate of loss has recently been as high as 18 percent of the remaining wetlands per year. In addition to drainage, physically changing the landscape for agricultural purposes can affect watercourses in a variety of ways — via clearing riparian vegetation, stabilizing and protecting banks, allowing cattle access to the water for drinking, and installing and operating stand pipes and pump houses for water withdrawal.

Agriculture contributes to surface and groundwater contamination via sediment, pathogens, pesticides, organic matter and nutrients. The use of fertilizers and pesticides has increased both absolutely and as a percentage of total farm expenses. Nutrients and animal manure can reduce water palatability, pose health risks and increase eutrophication.

In the Prairie provinces, constant dollar expenditures on fertilizers and pesticides more than doubled between 1966 and 1976, and then more than doubled again in the following decade. Such expenditures, only about $300-million in 1966, had reached over $1.3-billion in 1986. They had gone from being less than seven percent of total farm expenses in 1966, to being more than 16 percent of farm expenses two decades later.

The problem is enormous in scale, scope and complexity, affecting not only agricultural regions, but imposing a large cost on the country as a whole. The combined effects of erosion, acidification, salinization, and compaction may have cost Canadian farmers as much as $1.4-billion in 1987,[20] of which some $650-million would be attributable to erosion and salinity on the prairies alone.[21] Farm degradation has resulted in reduced crop yields and rising production costs. To provide a perspective on the problem from the point of view of agriculture, the landmark 1984 Senate report on Soil at Risk began, "Canada is facing the most serious agricultural crisis in its history and unless action is taken quickly, this country will lose a major portion of its agricultural capability."

ENVIRONMENTAL DAMAGE TO AGRICULTURE

Agriculture is negatively affected by a variety of factors. One is soil contamination. Included here are the disposal of sewage sludge on farmland, which can lead to the deposition of heavy metals such as mercury, cadmium, arsenic, lead, chromium, nickel, copper and zinc. Atmospheric industrial fallout is also a source of heavy metals and other troublesome chemicals in soils. Another factor is urbanization, which has often occurred on prime farmland, pushing agriculture onto less productive land.

Global warming, which could lead to a decline in soil moisture and a variety of other problems requiring major adjustments, is a pending problem. It is unclear, however, whether it should cause farmers to be optimistic or pessimistic. One recent survey suggests that while agriculture is the most climate-sensitive of the main economic sectors, farmers have historically shown an ability to adapt to different climatic zones and changing environmental conditions. The same source states that studies have suggested that greenhouse warming will reduce yields in many crops, but that the associated fertilization effect of higher CO2 will probably offset any climatic harm over the next century. [22] Other sources dismiss such pronouncements as unduly optimistic, for example:

> *It is still argued by some that climate change will have positive as well as negative effects, and that it is a problem with which societies can readily cope. But this ignores the extraordinary rate of change that is now projected, and the possibility of adjusting quickly enough.* [23]

5. FISHERY

Overfishing, along with wasteful and environmentally damaging fishing practices, have depleted many ocean fish stocks off Canada's coasts. Unless action is taken, stocks in many areas will decline beyond their capacity to regenerate. At the same time, the world's demand for fish is increasing.

The commercial fishing industry wants stable employment and higher incomes based on bigger catches. But the technology we control today allows fish stocks to be quickly decimated. In the case of the northern cod stocks, the advent of offshore fishing technologies after 1950 lead to a four-fold increase in catches by the 1970s. The result was a collapse of the stock, with inshore landings falling to figures lower than any recorded in the previous centuries. Today, scientists believe there is an urgent need to reduce by half the rate at which cod are caught. To achieve the necessary catch reductions, Canada will need both to cut domestic quotas and reach an effective international agreement to control overfishing just outside Canadian waters.

Canada has achieved international agreement on lowered quotas through the North Atlantic Fisheries Commission, but one member, the European Community (EC) has so far refused to comply. The community argues the quotas are not necessary, and has unilaterally set its own quota for cod at a level four times higher than that suggested by Canada.

Off Canada's west coast in the North Pacific, Japan, South Korea and Taiwan employ driftnets to capture squid but these nets also catch salmon and steelhead trout of U.S. and Canadian origin, other fish species, dolphins, seals, whales and seabirds. Driftnets are made of very strong, thin monofilament nylon, are 30 feet deep, and are up to 30 miles long. There are between 1,200 and 1,500 driftnet fishing vessels in the North Pacific, each capable of setting eight to 11 nets. The environmental damage caused by this practice, including declines in fish runs in Canadian rivers and northern fur seal, dolphin, and seabird populations, has not been properly documented.

The United States has enacted legislation that requires it to negotiate for observer and enforcement programs with Japan, South Korea and Taiwan. If negotiations fail, the President is empowered to begin trade sanctions against these nations. As a result of concerted international criticism, the UN General Assembly passed Resolution 44/225 in December 1989. Major policy and regulatory changes are called for by the end of 1992, including a ban on driftnets. The federal government of Canada is committed to taking all further action necessary to eliminate driftnet fishing. CCME already strongly supports provincial and federal government efforts to convince foreign governments of the serious environmental consequences of overfishing off the Atlantic and Pacific Coasts.

The success on the international scale has shifted public attention to domestic, inshore fisheries. A new target is trawl fishing and the use of bottom draggers to catch groundfish. In California, Proposition 132 (passed in November 1990) bans inshore gillnet fishing. In British Columbia, Greenpeace recently announced that its next target will be gillnets and bottom draggers. This issue presents a new debate for environmentalists, fishermen and government.

At ECO '92, Canada will pursue four objectives related to the fishery:

- an international sustainable fisheries strategy;
- an international framework for controlling land-based forms of ocean pollution;
- a strengthening of the provisions of the London Dumping Convention; and
- a global ocean observing system.

ENERGY

The environmental consequences of energy use are pervasive, playing an important, if not dominant, role in many of the key environmental issues of the day. The most serious pollution problems globally — the warming of the earth's climate, the depletion of the ozone layer, the acidification of the environment, and urban air pollution — are all attributable to a large degree to the combustion of fossil fuels. In Canada, these fuels contribute 41 percent of the sulphur oxides and 85 percent of the nitrous oxides released, the two most important ingredients in acid rain. However, other sources of energy are not without environmental consequences such as the massive ecosystem changes that accompany the construction of large hydroelectric projects and the still unresolved problem of disposing radioactive wastes from nuclear power generation.

In its report, the Brundtland Commission noted that "choosing an energy strategy inevitably means choosing an environmental strategy." The Commission went on to argue that "a safe and sustainable energy pathway is crucial to sustainable development; we have not yet found it".

There appears to be a significant degree of consensus among Canadians on the importance of markets in allocating energy resources. Virtually all energy stakeholders appear to welcome policy thrusts toward a more market-oriented and efficiency-driven energy policy. In this view, government should intervene in the allocative process only to correct serious market imperfections or failures. Unfortunately, this reliance on market forces has failed to properly account for environmental costs and to make industrial polluters pay for the environmental damage for which they are responsible. The energy sector, therefore, finds itself at the centre of the development of regulations, technologies and practices to minimize environmental, health and safety risks.

The environmental implications of the Free Trade Agreement should also be noted. Inasmuch as the agreement formalizes the existence of an energy market and accelerates the rate of Canadian resource development to meet North American needs, it can be expected to increase the environmental costs resulting from energy development.

1. ENERGY CONSERVATION

With about 0.5 percent of the world population, Canada accounts for two percent of the world's energy use. Canada is thus one of the most intensive users of energy in the world. Data from the International Energy Agency show that in 1985 Canada used 70 percent more energy per unit of GDP than the average of the United States and four major European economies. Although some of this difference is explained by geography and climate, critics of Canadian energy policy add another reason for it: a historical bias by policy-makers for increasing the supply of energy to meet demand. Indeed, the rapid economic growth of the western economies and Japan after World War II was facilitated by cheap and abundant energy supplies. This growth began to slow, however, in the 1970s when international oil supplies became more expensive.

Since the 1973 oil crisis, and, particularly, since the 1979 Iranian crisis, all industrial nations have succeeded in curtailing their use of energy. In fact, during this period, Canadians "found" twice as much energy through energy conservation than was added in new oil, gas and electricity supplies. As a result of government-sponsored energy conservation programs and the impact of higher prices, the energy intensity of the Canadian economy — that is, the amount of energy needed to produce one dollar of GNP — has dropped by about 14 percent between 1973 and 1986. Although substantial, this drop is only two-thirds of what other member states of the OECD realized over the same period. During the second half of the 1980s, the average rate of improvement in efficiency slowed down again; also there are wide differences among provinces in their approach to energy conservation.

The potential for further energy efficiency gains in Canada is believed to remain very large although experts disagree over its precise scope. In a recent study, the International Energy Agency estimated "conservatively" that further efficiency gains of 30 percent on average are feasible among its member states. For Canada, Dr. John Robinson of the University of Waterloo has calculated an untapped energy conservation potential of 43 percent. Similarly, a 1988 update of the soft energy path analysis first carried out in 1983 by Friends of the Earth indicates that it is entirely possible for Canada to achieve the 50 percent reduction in primary energy intensity suggested by the World Commission for Environment and Development (WCED) as a target for industrial nations.

A number of alternative energy initiatives have been undertaken during the past two decades by the federal government in order to modify future energy requirements and to reduce atmospheric emissions. These measures have included the promotion of propane and natural gas as cleaner vehicle fuels, and the technological development of non-traditional sources of energy such as solar energy, wind power, geothermal energy and bioenergy.

The federal, provincial and territorial governments have also endeavoured to reduce household and commercial energy use in the form of heat, lighting and motive power, through various other initiatives. These have included improved insulation standards for new building construction and subsidies to upgrade insulation in older buildings; conversion from oil heating to cheaper and cleaner gas heating; introduction of more efficient furnaces; a shift to smaller automobiles with better fuel efficiency; and improved utilization of industrial waste heat.

The provincial hydroelectrical utilities will have a major role to play in encouraging increased energy efficiency. Although some utilities, notably in British Columbia, Ontario and Quebec, have already launched energy conservation programs, these remain far less aggressive than many similar programs found in the United States. Regulatory changes will be required to encourage utilities to engage in least-cost energy planning.

Advanced energy efficiency measures for new residential buildings have been actively pursued by the federal government through the development of the R-2000 house and the establishment of the federal Measures for the Conservation of Energy in New Buildings. So far, Quebec is the only province which has incorporated these advanced measures into its provincial building code.

Such energy conservation measures have helped to slow the growth in overall energy use. While between 1974 and 1980, energy use grew by an average of 2.3 percent annually, the rate dropped to about one percent per year in the first half of the 1980s. Not surprisingly, official predictions of future Canadian energy demands have also fallen from a 4.4 percent annual increase, projected in 1973, to one of between 1.5 and 1.9 percent in the National Energy Board's 1986 report. A recent NEB demand study, for the period 1987-2005, concluded that energy demand will likely grow at a rate lower than the overall rate of economic growth.

What we're facing is roughly the equivalent of closing down the entire auto industry in the province of Ontario.

- Premier Clyde Wells,
The Ottawa Citizen,
February 3, 1990

Environment should be accorded the same importance as other economic and social goals in the planning, development and use of energy.

- Report on the Energy
Options Process, 1988

Table 4

INTERNATIONAL COMPARISON
Energy Use Per Capita
1987

COUNTRY	ENERGY USE GIGAJOULES PER CAPITA
Canada	291
United States	280
United Kingdom	150
France	109
West Germany	165
Italy	105
Japan	110

SOURCE: World Resources Report, 1990-91. Washington: World Resources Institute

2. NUCLEAR POWER GENERATION

Electrical energy produced by nuclear fission has remained an issue so controversial that unemotional, objective assessment is almost impossible. Public mistrust of the safety of nuclear installations, and fear of the consequences of nuclear mishaps decidedly exist. Nuclear power stations can produce vast amounts of electrical energy without adding to global warming and they operate without the massive loss of land areas or the toxic methylmercury accumulations that usually accompany large hydroelectric developments. However, the disposal of accumulated radioactive fuel waste and the wastes associated with uranium mining are of concern.

More than 15 percent of Canada's electricity is produced from nuclear power. Several atomic plants operated by Ontario Hydro generate the bulk of this capacity. N.B. Electric Power Commission and Hydro-Québec also manage one station each. All nuclear-generated electric power in Canada is produced by CANDU reactors, designed by Atomic Energy of Canada Limited (AECL). Although there have been no serious accidents involving CANDU reactors anywhere in the world, public mistrust of atomic energy has been fuelled by the Three-Mile Island accident and, in particular, the Chernobyl nuclear reactor disaster.

The safe disposal of radioactive wastes has also continued to be of public concern, and has been examined by Environmental Assessment Review Process panels and federal task forces. Currently, an EARP panel is reviewing options for nuclear fuel waste management, including AECL's preferred concept of sealing accumulated fuel waste in underground vaults in stable plutonic rock formations.

Environmental organizations such as Greenpeace, Energy Probe and Friends of the Earth have consistently opposed the development of the nuclear power industry, including AECL's waste burial concept. These groups view it as morally reprehensible that future generations should be forced to cope with accumulations of dangerous radioactive substances so as to enable the present society to continue its wasteful ways.

Such arguments recently have led the Ontario government to place a three-year moratorium on new nuclear development projects, and to require Ontario Hydro to divert $240-million into an energy conservation and efficiency program. Premier Bob Rae considers the success of conservation in cutting electricity demands to be the key to eliminating the need for more nuclear plants.

The use of nuclear energy has to be viewed in the context of many other environmental, economic, social and political issues of current importance. These include:

- the role of the NEB and provincial electrical utilities in exporting electricity and in shaping national energy policies;
- human-induced climate change, specifically, the phenomenon of global

warming;

- energy conservation as an element in the thrust toward sustainable resource development;
- public apprehension regarding nuclear energy use;
- the environmental organizations' resolve to eliminate the nuclear option;
- the current opposition of northern native organizations to uranium mining in areas involved in land claims negotiations.

3. FRONTIER OIL AND GAS DEVELOPMENT

Development of frontier oil and gas resources continues to be a controversial topic, involving a host of stakeholders. The remote locations, complex technology and large expenditures confer megaproject status to nearly every individual endeavour, thus ensuring close scrutiny from media, special interest groups and the general public. Furthermore, project locations in the Arctic or offshore imply that frontier oil and gas development activities, potentially, have serious implications for the protection of the environment, and for the social and economic well-being of the areas' residents.

Frontier oil and gas development has to be assessed in the context of: federal/ provincial/ territorial relationships — specifically, the devolution of federal responsibilities to the territorial governments, and the joint resource management and revenue sharing agreements; northern native land claims settlements and their implementation; future Canadian energy options and demand scenarios; the world oil situation; and the implications of global climate change.

In the Atlantic region, the $5.6-billion Hibernia Project (Mobil Oil and Partners), located on the Grand Banks, has received all required approvals and is scheduled to start production in 1996. The endeavour is expected to produce 83 million cubic metres of crude oil during a 15-year extraction period. [24] The $565-million Panuke/Cohasset Project (LASMO and Nova Scotia Resources), located near Sable Island, has also been approved. It is expected to produce 5.6 million cubic metres of very light oil over a 6-year period, starting in 1993. [25]

Beaufort Sea exploration is at present relatively inactive, in part through a dispute involving COGLA and the Environmental Impact Review Board, set up under the Inuvialuit Final Agreement. A consensus -seeking steering committee has been formed to try to resolve this situation.

For the Mackenzie Delta, three competing proposals to bring natural gas to southern markets by means of a pipeline are pending before the National Energy Board. The NEB has recommended that export to the United States of 11 trillion cubic feet of natural gas from the Delta be authorized. Pipeline hearings are unlikely before 1992.

The primary area of responsibility for frontier oil and gas development is in the federal sphere through ownership of resources on federal lands and the offshore. However, management roles are now shared with Nova Scotia and

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Frontier oil and gas development has to be assessed in the context of: federal/ provincial/ territorial relationships — specifically, the devolution of federal responsibilities to the territorial governments, and the joint resource management and revenue sharing agreements; northern native land claims settlements and their implementation; future Canadian energy options and demand scenarios; the world oil situation; and the implications of global climate change.

In the Atlantic region, the $5.6-billion Hibernia Project (Mobil Oil and Partners), located on the Grand Banks, has received all required approvals and is scheduled to start production in 1996. The endeavour is expected to produce 83 million cubic metres of crude oil during a 15-year extraction period.[24] The $565-million Panuke/Cohasset Project (LASMO and Nova Scotia Resources), located near Sable Island, has also been approved. It is expected to produce 5.6 million cubic metres of very light oil over a 6-year period, starting in 1993.[25]

Beaufort Sea exploration is at present relatively inactive, in part through a dispute involving COGLA and the Environmental Impact Review Board, set up under the Inuvialuit Final Agreement. A consensus -seeking steering committee has been formed to try to resolve this situation.

For the Mackenzie Delta, three competing proposals to bring natural gas to southern markets by means of a pipeline are pending before the National Energy Board. The NEB has recommended that export to the United States of 11 trillion cubic feet of natural gas from the Delta be authorized. Pipeline hearings are unlikely before 1992.

The primary area of responsibility for frontier oil and gas development is in the federal sphere through ownership of resources on federal lands and the offshore. However, management roles are now shared with Nova Scotia and

Newfoundland through the respective accords. Discussions are underway for a similar Northern Accord with the territorial governments. A Pacific Accord with British Columbia is also likely in the next few years. Key players are the energy, finance and environment ministers for Canada, Newfoundland, Nova Scotia, British Columbia, Yukon and the Northwest Territories; the hydrocarbon industry; provincial utility corporations; native organizations; and environmental groups.

FOOTNOTES

1 Alain Giguère, Presentation on Changes in Public Attitudes and Perceptions of Global Climate Change. Cited in Parliamentary Forum on Global Climate Change. Ottawa: House of Commons, 1990.

2 A Southam Environment Project. Ottawa Citizen, October 7, 1989.

3 The Ottawa Citizen, October 2, 1989.

4 Great Lakes: Great Legacy?; Ottawa and Washington: IRPP and the Conservation Foundation, 1989.

5 National Environmental Policy Plan. The Hague: Second Chamber of the States General, 1989.

6 This Common Inheritance; London: HMSO, 1990.

7 "Un Plan National pour l'Environnement". Environnement Actualité, Vol 122, sept. 1990.

8 The Hon. Thomas R. Berger, "The North as Frontier and Homeland", in The Arctic, Choices for Peace and Security, True North Strong and Free Inquiry Society, Edmonton, 1989.

9 External Affairs and International Trade Canada, Protecting the Arctic Environment, Report on the Yellowknife Preparatory Meeting, Ottawa, 1990.

10 Study Team Report to the Task Force on Program Review ("Nielsen Task Force"). Major Surveys. Ottawa: Minister of Supply and Services, 1986.

11 The Stakeholder Group on Environmental Reporting, A Study of Environmental Reporting in Canada. Ottawa: Minister of Supply and Services, 1986.

12 Watershed, The Royal Commission on the Future of the Toronto Waterfront

13 Summary of the workshop on risk assessment as an environmental management tool, February 1990, p 3. Prepared by Concord Scientific Corporation for the Canadian Council of Ministers of the Environment.

14 "A Survey of Industry and the Environment", The Economist, September 8, 1990, p.10.

15 "A Survey of Industry and the Environment", The Economist, September 8, 1990, p.17

16 Green Plan, p.165.

17 Mary Cann, "Hagersville", Emergency Preparedness Digest, April-June, 1990

18 Mr. Glen Blouin, Executive Director, Canadian Forestry Association, Submission before the House of Commons Committee Hearing on Bill C-29, The Department of Forestry Act, October 12, 1989, Issue No. 2, page 2:5.

19 Senate, Soil at Risk, 1984.

20 Environment Canada, Environment and Development, A Canadian Perspective, Supply and Services, Ottawa, 1987.

21 Science Council of Canada, 1986, A Growing Concern: Soil Degradation in Canada, Supply and Services, Ottawa.

22 William D. Nordhaus, "Count before you leap", The Economist, July 7, 1990, p. 22

23 Lester R. Brown, Christopher Flavin, and Sandra Postel, "A World at Risk", State of the World, 1989, World Watch Institute, p.10.

24 Decision 90.01, Can.-Nfld. Offshore Petroleum Board, 1990.

25 Annual Report 1989-90, Can.-N.S. Offshore Petroleum Board, 1990.

BIBLIOGRAPHY

This Common Inheritance. London: HMSO, 1990.

Agriculture Canada. Contamination of Water by Agriculture, Chemicals and Animal Wastes. Unpublished report. 1987.

Agriculture Working Group on Environmental Sustainability. (1990) Report to Ministers of Agriculture, Federal-Provincial Agriculture Committee on Environmental Sustainability. 1990.

Aitken, R. and G. Lecuyer. Report of the National Task Force on Environment and Economy. Submitted to the Canadian Council of Resource and Environment Ministers. 1987.

Amyot, J-P.Canada's Forests: No Future Without Good Management. Ottawa: Library of Parliament. 1984.

_____. Information on Forestry in Sweden and Clear-Cutting Practices. Ottawa: Library of Parliament, Research Branch, 1989.

Anderson, M. et al. (1984) Agricultural Land Degradation in Western Canada: A Physical and Economic Overview. Ottawa: Regional Development Branch, Agriculture Canada, 1984.

Angus Reid Group. Southam Environment Project Survey. Winnipeg, 1989.

Bertrand, F. et al. Currents of Change. Final Report of the Inquiry on Federal Water Policy. Ottawa, 1985.

Bordages, J-L. Rain Forests in Canada and Brasil . Ottawa: Library of Parliament, Research Branch, 1990.

Bregha, F. et al. (Rawson Academy of Aquatic Science). The Integration of Environmental Considerations into Government Policy. Ottawa: Canadian Environmental Assessment Research Council, Ministry of Supply & Services. Catalogue number En107-3/19-1990.

Brown, L.R., et al. (1990) State of the World. London: W.W. Norton & Company,1990.

Brown, L.R., C. Flavin, and S. Postel. A World at Risk. Washington: World Watch Institute, 1989.

Canadian Council of Forestry Ministers. A National Forest Sector Strategy for Canada. Saint John, 1987.

Canadian Environmental Network. 2025: Soft Energy Futures for Canada - 1988 Update. Paper for Energy Options Policy Review, 1990.

Committee on the Status of Endangered Wildlife in Canada. Canadian Endangered Species List. Presented to the Standing Committee of the Federal-Provincial Wildlife Conference, 1990.

Conservation Foundation. State of the Environment: A View Toward the Nineties. Washington, 1987.

Dene Cultural Institute. Traditional Ecological Knowledge and Environmental Assessment. 1989.

Embree, C. Multilateral Environmental Treaties, Conventions and Agreements: Implementation and Compliance in Canada. Toronto: Faculty of Environmental Studies, York University, 1990.

Energy, Mines and Resources. Energy in Canada. A background paper. Ottawa, 1987.

Energy, Mines and Resources. Energy and Canadians: Into the 21st Century. Report on Energy Options Process. 1988.

Energy, Mines and Resources. Energy Use and Atmospheric Change. A discussion paper. Ottawa, 1990.

Energy Options. Energy Options: Energy and the Environment.: Report on Seminar Proceedings, Niagara-on-the-Lake. 1987.

Environment Canada. Climate Change and Variability. A fact sheet. Downsview: Atmospheric Environment Service, 1986.

Environment Canada. Environment and Development: A Canadian Perspective. Ottawa: Supply and Services, 1987.

Environment Canada.Canada's Green Plan. Ottawa: Supply & Services, 1990.

Environment Canada. National Urban Air Quality Trends 1978 to 1987. Environmental Protection Series Report EPS 7/UP/3. Ottawa: Environment Canada, 1990.

Environment Canada. State of the Environment Report for Canada. Ottawa: Supply and Services, 1986.

External Affairs and International Trade Canada. Protecting the Arctic Environment., Report on the Yellowknife Preparatory Meeting, Ottawa, 1990.

Filion, F.L. et al. The Importance of Wildlife to Canadians: Highlights of the 1981 National Survey. Ottawa: Canadian Wildlife Service, 1983.

Filion, F.L., A. Jacquement, and R. Reid. The Importance of Wildlife to Canadians: An executive overview of the recreational economic significance of wildlife. Ottawa: Canadian Wildlife Service, 1985.

Filion, F.L., S. Parker, and E. DuWors. The Importance of Wildlife to Canadians: Demand for wildlife to 2001. Ottawa: Canadian Wildlife Service, 1988.

Forest Industry Advisory Committee. Trade and Commerce and Regional Economic Expansion . Interim Report to the Minister of Industry, 1983.

Forestry Canada. Canada's Forests 1989. Ottawa: Supply and Services, 1990. Catalogue No. Fo51-1/1989E.

Giguère, A. Changes in Public Attitudes and Perceptions of Global Climate Change. Parliamentary Forum on Global Climate Change. Ottawa: House of Commons, 1990.

Government of the Netherlands. National Environment Policy Plan. The Hague: Second Chamber of States General, 1989.

Greenprint for Canada Committee. Greenprint for Canada: A Federal Agenda for the Environment. Ottawa, 1989.

Harris, L. Independent Review of the State of the Northern Cod Stock. Ottawa: Communications Directorate, Department of Fisheries and Oceans, 1990. Supply and Services Canada Catalogue No. Fs23-159/1990E.

Hatfield, H.R. Clear-cut vs. Selection. Victoria: Forest Planning Canada, 1988. Vol.4, No.4.

Imperial Oil Ltd. Canadian Energy Efficiency Comparison with other Industrial Nations. Submission to Energy Options, 1987.

Institute for Research on Public Policy and Conservation Foundation. Great Lakes Great Legacy. Maryland: Conservation Foundation, 1990.

International Joint Commission. Great Lakes Water Quality Agreement of 1978. Government of Canada, U.S.A., 1988.

International Union for the Conservation of Nature and Natural Resources. World Conservation Strategy. Gland (Switzerland), 1980.

Jablanczy, J. Sustainable Silviculture: Redefining Fundamental Issues . Victoria: Forest Planning Canada, 1988. ,Vol.4, No.1.

Jacobson, J. and S. Jacobson. Toxic Contaminants and Ecosystem Health: A Great Lakes Focus . Vol. 21, Wiley Series, 1988.

Kelly, D. and G. Braasch. Secrets of the Old Growth Forest . Salt Lake City: Gibbs Smith, 1988.

Kuhnke, D.N. Silviculture Statistics for Canada: An 11-year Summary. Northern Forestry Centre, Information Report NOR-X-301. Ottawa: Forestry Canada, 1989.

Miller, D. Parliamentary Forum on Global Climate Change . Ottawa: House of Commons, Minutes of Proceedings, 1990.

National Energy Board. Canadian Energy: Supply and Demand 1987-2005. Ottawa, 1988.

National Research Council. Regulating Pesticides. Washington: National Academy of Sciences, Washington, 1980.

Pearce, D. Policies, Incentives and Regulation. Paris: Conference on Environmental Management in Developing Countries, 1990.

Pesticide Registration Review Team. Recommendation for a Revised Federal Pest Management Regulatory System. Final Report. Ottawa, 1990.

Public Review Panel on Tanker Safety and Marine Spills Response Capability. Protecting our Waters. Ottawa: Supply and Services, 1990. Catalogue No. EN 21-91/1990E.

Rawson Academy of Aquatic Science. Environmental Management under Native Self-Government. Ottawa, 1989.

Rawson Academy of Aquatic Science. Towards an Ecosystem Charter for the Great Lakes - St. Lawrence, Occasional Paper No. 1. Ottawa, 1989.

Resource Futures International. Environmental Performance Indicators: An Information package for Southam News. Ottawa, 1990.

Royal Commission on the Future of the Toronto Waterfront. Watershed. Toronto, 1990.

Science Council of Canada. A Growing Concern: Soil Degradation in Canada. Ottawa: Supply and Services, 1986.

Science Council of Canada. Canada's Threatened Forests. Ottawa, 1983.

Senate of Canada. Soil at Risk . Ottawa, 1984.

Shulka, J., et al. "Amazon Deforestation and Climate Change". Science, Vol. 247 (1990), p. 1,325.

Slavik, J., R. Wallace, and J. Boucher. Environmental Mediation in Major Oil Sands Development: An Alternative Model to Resolution of Native, Corporate and Government Interests in Resource Development Approvals Processes. Energy Processing Canada, 1988.

Statistics Canada. Human Activity and the Environment. Ottawa: Structural Analysis Division, Analytical Studies Branch, Statistics Canada, 1986.

Synergistics Consulting Ltd. Public Opinion and the Environment . 1988.

World Commission on Environment and Development. Our Common Future. New York: University Press, 1987.

World Wildlife Fund Canada. Endangered Space Progress Report No. 1. Ottawa: 1990.

Wright, W.J. Ripples, Tides and Waves: Canadian Public Opinion and the Environment. Winnipeg: Angus Reid Group, 1990.